

THE GENUS CIENFUEGOSIA CAV. (MALVACEAE)

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ABSTRACT

One novelty, *Cienfuegosia rosei*, is included in the 24 species recognized in this taxonomic revision of the genus. A new subgeneric classification is presented, with two subgenera and seven sections.

INTRODUCTION AND HISTORICAL ACCOUNT

Cienfuegosia is a member of the tribe *Gossypieae* of the *Malvaceae*. Some authors have placed these plants (tribe *Hibisceae* sens. lat.) in the *Bombacaceae*, but the evidence now suggests that they are better retained in the *Malvaceae* (Fryxell, 1968).

The genera included in the *Gossypieae*, in addition to *Cienfuegosia*, are *Gossypium* L., *Thespesia* Corr., *Gossypioides* Skov. ex Hutch., *Hampea* Schlecht., *Kokia* Lewt., *Cephalohibiscus* Ulbr. and *Lebronnecia* Fosb. The principal unifying features that characterize the members of this tribe and which distinguish them from other genera (especially from the *Hibisceae* sens. str.) are (a) the conduplicate embryos, and (b) the presence of pigment glands distributed to various parts of the plant, together with the presence of certain sesquiterpene-like pigments associated with these glands. These pigments (principally gossypol but also several other chemically related compounds) are apparently unique to the tribe *Gossypieae* (Lukefahr & Fryxell, 1967; Fryxell, 1968).

Various botanists have dealt with species of *Cienfuegosia* since Cavanilles established the genus in 1787.

Garcke (1860) was the first of the few who have dealt comprehensively with the entire genus. Fully two-thirds of the species now known were undescribed in Garcke's time.

Hochreutiner (1902) dealt inclusively with the group, but he simply listed the species known at that time, and indicated synonymy and effected nomenclatural changes. He did not attempt to deal with the classification, distribution, or phylogeny of the group. He accepted a circumscription of the genus that was much broader than is now considered valid.

Ulbrich (1914) also simply listed the species and accepted a similarly broad conception of the genus. Hutchinson (1947) provided a delimitation of the genus with which I am in closer agreement, although his treatment of the individual species is not entirely convincing.

Gürke (in Martius, 1892) considered only the species that occurred in or near Brazil; Robinson (1895) treated only the North American species; Rodrigo (1941, 1948) dealt only with the Argentine species; Hutchinson and Dalziel

(1928) and Exell and Wild (1961) included only the species from specific regions of Africa.

The present study intends to deal in a comprehensive manner with the description and classification of the genus *Cienfuegosia*.

Cavanilles (1787) first described this genus and named it *Cienfuegosia* in honor of the 16th century Spanish botanist Bernardo Cienfuegos, author of "Historia de las plantas." Two years later, A. L. de Jussieu (1789) shortened the generic name to *Fugosia*, the name under which these plants were most commonly known during the ensuing seventy years. During these seventy years, three other variant spellings of the name were published. Linnaeus (posthumously, under the editorship of P. D. Giseke, 1792) published the variant "*Cienfugiosa*." Another variant was the contraction, *Cienfuegia*, of Willdenow (1800). *Cienfugosia* was published by DeCandolle (1824), an error that was perpetuated recently by Hutchinson (1947).

Although *Fugosia* is best regarded as an etymological variant of *Cienfuegosia* and not as a distinct concept, its orthography has been so greatly altered that combinations with the one name cannot automatically be transferred to the other, but must be handled as distinct combinations.

Garcke (1860) reviewed this history and noted the priority of Cavanilles' name. Consequently he transferred several species to *Cienfuegosia* that had been published under the invalid name *Fugosia*.

Ventenat (1800) published the name *Redutea* for a plant that must now be included in *Cienfuegosia*. Ventenat chose this name in honor of the botanical artist, P. J. Redouté, but intentionally altered the orthography in naming the plant. Ventenat's spelling was used by Persoon (1806), but almost all other subsequent authors have cited the name as *Redoutea* Vent., which is the spelling that Kunth used in publishing *Redoutea* Vent., which is the spelling that Kunth used in publishing *Redoutea tripartita* H.B.K. This error may have been perpetuated partly because Index Kewensis lists the name in this way, as does Willis (1966), who moreover attributes *Redutea* to Persoon.

Buckley (1862) published the genus *Elidurandia* (in honor of the botanist Elias Durand) for a plant that must be held indistinguishable from that which Gray (1852) had previously described as a species of *Fugosia*. The name *Elidurandia texana* Buckl. has never achieved currency beyond the original publication and in subsequent citations of synonymy, presumably because Gray (1863) early published his view that the two plants were the same. (Although Shinnars (1962, note 5) attempts to defend Buckley against Gray, Gray was certainly correct in this instance.)

RELATIONSHIPS OF THE GENUS

Recently Fryxell (1968) presented a key, distinguishing *Cienfuegosia* from other genera of the *Gossypieae*. There is sufficient variability among the species of *Cienfuegosia* that a combination of characters is generally required to separate it from the other genera. Chromosome number appears to distinguish *Cienfuegosia* (for which $n = 10$ or 11) clearly from the other genera (for which $n = 12$ or

13); but counts are not yet known for the two monotypic genera *Cephalohibiscus* and *Lebronnecia*.

Plant habit also serves to distinguish *Cienfuegosia* from other members of the tribe. *Cienfuegosia* varies from the relatively robust shrub, *C. affinis*, to procumbent herbs such as *C. argentina*. Arboreal forms never occur in *Cienfuegosia*. By contrast *Thespesia*, *Hampea*, *Cephalohibiscus*, *Lebronnecia*, and *Kokia* are typically arborescent (and occasionally shrubby); *Gossypium* and *Gossypioides* are typically shrubby (or occasionally arborescent in the former genus). None of the genera of *Gossypieae* other than *Cienfuegosia* includes herbaceous plants.

A few additional characters merit brief comment. Lewton (1925) discussed the unsatisfactory nature of the number of cells in the capsule as a character for distinguishing genera. Cell number is constant for some genera (three in *Hampea*, *Kokia*, and *Lebronnecia*; five in *Cephalohibiscus*), but varies from three to five among the species of *Cienfuegosia*, *Gossypium*, *Gossypioides*, and *Thespesia*. It is often useful in delimiting lower taxa, however.

The presence of an involucl is characteristic of most plants of the *Gossypieae*. The number of parts of the involucl is of value in classifying these plants at both the generic and specific levels. The genera *Gossypium*, *Gossypioides*, *Hampea*, *Cephalohibiscus*, *Lebronnecia*, and *Kokia* uniformly have involucls of three bractlets. The involuclal bractlets of *Thespesia* and *Cienfuegosia* are more variable, ranging from none (in *Cienfuegosia* sect. *Friesia*) to as many as 20 (in *Thespesia multibracteata* Borss.); but within these genera the number and disposition of bractlets are of taxonomic significance. Attempts to use the form of the bracts as a diagnostic character have not succeeded (Lewton, 1925). The bracts are often caducous in *Thespesia* and in two species of *Gossypium*, but are persistent in the remainder of the tribe.

Involuclal nectaries are found in threes at the summit of the pedicel directly below the point of insertion of the involuclal bracts. (An additional set of three may also occur, alternate with and above the bracts, in the cultivated species of *Gossypium*.) These nectaries are characteristic of the tribe *Gossypieae*, although they do not occur in all of the species. They are absent in the *Hibisceae* sens. str., although species of *Hibiscus* sect. *Furcaria* have nectaries located directly on the calyx (cf. Janda, 1937). The presence or absence of involuclal nectaries is useful in delimiting lower taxa.

The gametic chromosome number in *Thespesia*, *Hampea*, and *Gossypium* is $n = 13$, with allotetraploidy occurring in *Gossypium*. In *Gossypioides* and *Kokia* the number is $n = 12$. The numbers for *Lebronnecia* and *Cephalohibiscus* are not known. In *Cienfuegosia* numbers of $n = 10$ and 11 have been reported (cf. Table 2).

In addition to the morphological similarities (Fryxell, 1968) that imply phylogenetic relationships, other evidence further substantiates such relationships.

Skovsted (1944) presented evidence from experimental studies with *C. hildebrandtii* that suggests a distant relationship with *Hibiscus*. *Hibiscus rubidus* Skov. and *H. bifurcatus* Cav. set fruit with empty seeds when pollinated by *C. hildebrandtii*. (According to Menzel and Wilson (1961) these two species are

correctly identified as *H. acetosella* Welw. & Hiern. and *H. radiatus* Cav. respectively.) In addition, *C. hildebrandtii* grew vigorously and flowered when grafted onto *Hibiscus esculentus* L. (= *Abelmoschus esculentus* (L.) Moench).

An affinity of *Cienfuegosia* with *Gossypium* is indicated by indirect evidence. One line of evidence concerns the ability of the cotton rust (*Puccinia stakmanii* Presl.) to infect *C. argentina* to a limited extent; this rust fails to infect other species outside of *Gossypium* (cf. Savile, 1954). The cotton rust is an obligate heteroecious rust that alternates between *Gossypium* spp. and *Bouteloua* spp. (Presley and King, 1943; Blank and Leathers, 1963). It occurs in northern Mexico and adjacent parts of Arizona, New Mexico, and Texas. Its primary grass hosts are *Bouteloua aristidoides* (H.B.K.) Griseb. and *B. barbata* Lag., both annuals, though not closely allied. The aecial stage will develop on most species of *Gossypium* (Presley and King, 1943; Blank, personal communication), and can constitute an economic hazard in commercial plantings of cotton in years favorable to rust development. The rust, however, is not known to infect malvaceous plants other than *Gossypium* spp. and *Cienfuegosia argentina*. On *C. argentina* pycnial lesions will form, but these quickly regress and do not develop to the aecial stage.

Attempts to infect other species of *Cienfuegosia* with *Puccinia stakmanii* have given negative results with *C. affinis*, *C. drummondii*, *C. sulfurea*, *C. heterophylla*, *C. yucatanensis*, *C. hildebrandtii*, and *C. hearnii* (Blank, unpublished).

It was therefore of interest to discover aecial rust lesions occurring naturally on *Cienfuegosia* in Argentina. Two specimens in the Geneva herbarium (*Rodriguez 12*, of *C. argentina*; and *Monetti 14711*, of *C. hispida*) each show several well-developed aecial lesions. Both were collected in Tucumán in 1913, which may have been a favorable year for the rust in that area.

A request to Ing. M. Gutiérrez (Estación Experimental Agropecuaria, P. R. Sáenz Peña, Chaco) for field observations of rust on *Cienfuegosia* brought a positive response. A. Schulz collected and forwarded for study leaves of *C. ulmifolia* bearing aecial lesions. Schulz observed that 10% of the plants in a natural population in eastern Chaco were infected. Plants of *C. drummondii* and *C. sulfurea* growing in the same area were not infected.

One can conclude, therefore, that a rust endemic to northern Argentina occurs naturally on species of *Cienfuegosia* sect. *Friesia*, and is probably confined to these species. Moreover, the rust is probably a taxon distinct from *Puccinia stakmanii*. This conclusion is substantiated by two facts: (a) *P. stakmanii* infects *C. argentina* incompletely; and (b) rust does not occur in Argentina on the commercial cotton crop (Gutiérrez, personal communication), even though both *Bouteloua aristidoides* and *B. barbata* occur in Argentina. Observations of uredial or telial rust stages on these grasses are at present lacking.

Another line of evidence is given by the host relations of certain insect species that have become pests of cotton and hence of economic importance, particularly those whose host range is relatively narrow. The evidence given by Szumkowski (1952, 1953), Whitcomb & Britton (1953), and Lukefahr & Martin (1962) indicates an affinity of *C. affinis* with *Gossypium*, in that *Alabama argillacea* (Hüb-

ner), *Sacadodes pyralis* Dyar, and *Anthonomus grandis* Boh. are able to develop essentially normally on *C. affinis*.

The red bollworm of cotton, *Diparopsis castanea*, also occurs on *C. hildebrandtii* which is probably its original host (Marshall et al., 1937; Pearson, 1954). *Diparopsis watersi* and *D. tephrogramma* occur on *C. digitata* Cav. and *Gossypium anomalum* Wawr. ex Wawr. & Peyr. (Pearson, 1954), but not on *C. heteroclada* (Emsley, 1957).

Finally, the vernacular names of *C. affinis* (see p. 217), all of which may be translated roughly as "wild cotton," and of the Arabian *Cienfuegosia* (Hearn, 1968) indicate an observed resemblance to *Gossypium*.

ECOLOGY

The genus *Cienfuegosia* occurs in a variety of habitats. Yet the general pattern indicates an adaptation to relatively dry or otherwise unfavorable habitats. A few species occur in the severest of xeric environments, notably *C. tripartita*, *C. chiarugii*, *C. hearnii*, *C. rosei*, and *C. welshii*. A few of the more shrubby species are grassland plants; *C. heteroclada* from Nigeria and Ghana is especially adapted to its dry grassland environment because it flowers and fruits directly from the perennial root within a relatively short season (Emsley, 1957), and *C. integrifolia* from Paraguay may be similarly adapted. Many of the South American species occur in chaparral association on sandy soils. Others favor heavy soils. The species of sect. *Friesia* often occur in saline environments. *Cienfuegosia yucatanensis* provides an interesting example in that in Yucatan it occurs on arid, stony soils, while in Florida, Cuba, and Bahama it is found in more mesic environments.

DISTRIBUTION

Subgenus *Articulata* is African (Fig. 1) and subg. *Cienfuegosia* is American (Figs. 2-5), with the exception of *C. digitata*, which occurs in Africa.

Subgenus *Articulata* is herein divided into three sections: *Articulata*; *Dioica*; and *Garckea*. Section *Articulata* has a single species, *C. gerrardii*, with a relatively narrow distribution in Natal and the Transvaal. Section *Dioica* also has a single species, *C. heteroclada*, with a restricted distribution from northern Nigeria to northern Ghana. Section *Garckea* has five species, four of which occur around the borders of the Gulf of Aden, the fifth occurring primarily in southeast Africa. None of these species, with the possible exception of *C. hildebrandtii*, is particularly widespread or abundant. The somewhat greater range of *C. hildebrandtii* may result from its probably greater potential for seed dispersal. The distributional pattern of these species does not suggest a precise localization of a "center of origin" for the subgenus.

Subgenus *Cienfuegosia* is divided into four sections: *Cienfuegosia*; *Robusta*; *Paraguayana*; and *Friesia*. Section *Cienfuegosia* (Fig. 2) includes six widely scattered species (cf. Fryxell, 1967b), one of which has a disjunct distribution in southern and in northwestern Africa. The other five have discrete and restricted distributions in the following places: Paraguay, Ecuador-Peru, Venezuela, Mexico, and around the Gulf of Mexico (parts of Yucatan, Florida, Bahama, and Cuba).



Fig. 1. Distribution of *Cienfuegosia* subg. *Articulata*.

Section *Robusta* (Fig. 3) includes three species, two of which are primarily Brazilian in distribution, extending to Venezuela and Paraguay; the third is Mexican. Section *Paraguayana* (Fig. 4) includes four species that occur in Paraguay and northern Argentina, although one of them, *C. drummondii*, also occurs in southern Texas. Section *Friesia* (Fig. 5) includes four species found primarily in northern Argentina and Paraguay.

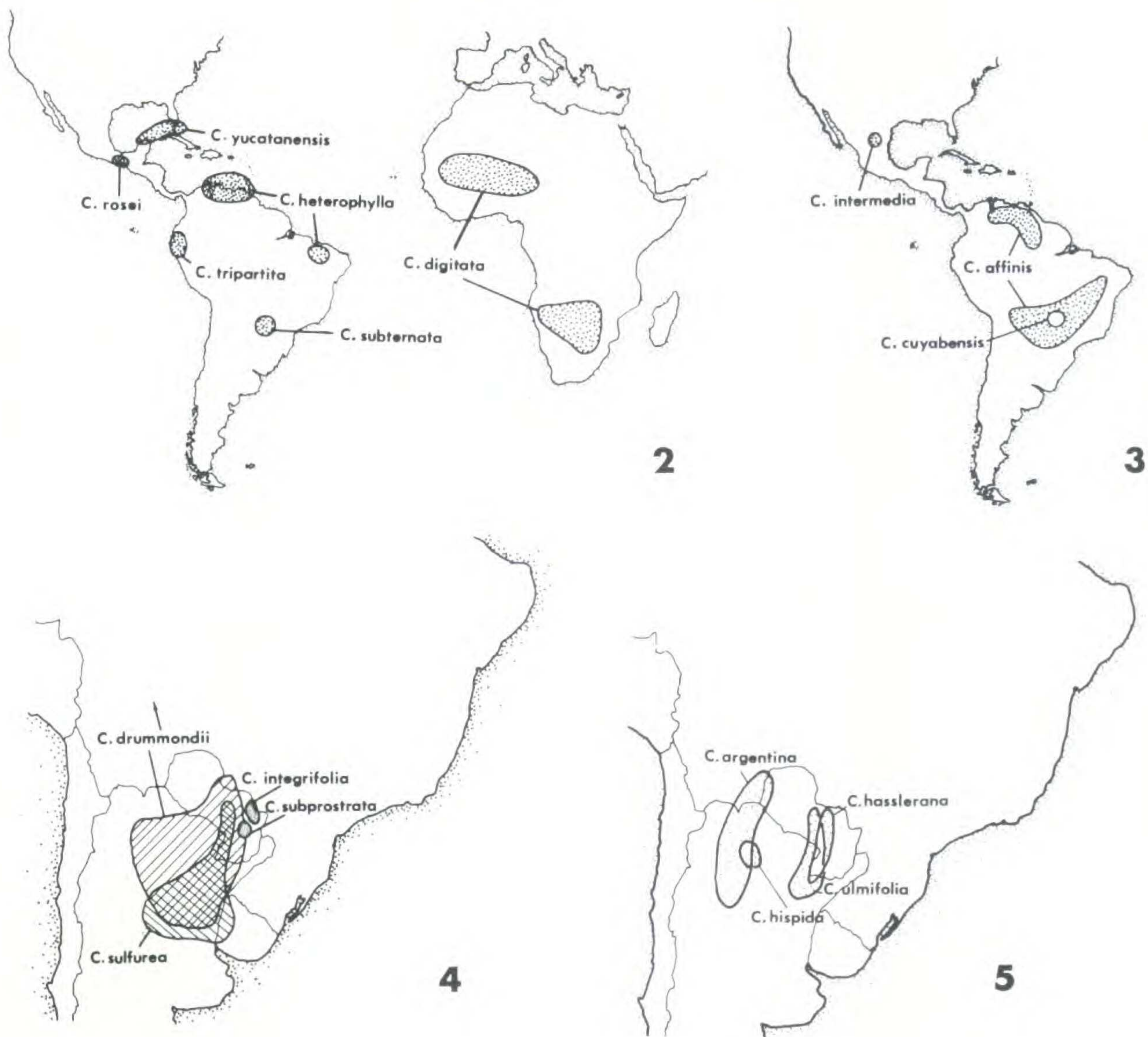


Fig. 2. Distribution of *Cienfuegosia* sect. *Cienfuegosia*. Fig. 3. Distribution of *Cienfuegosia* sect. *Robusta*. Fig. 4. Distribution of *Cienfuegosia* sect. *Paraguayana*. Fig. 5. Distribution of *Cienfuegosia* sect. *Friesia*.

The distribution patterns point to Paraguay as the center of dispersal of the group. Nine species occur within Paraguay, primarily in the southeastern half of the country; three of these are endemic to Paraguay. No other area has comparable diversity.

The general pattern of disjunction previously discussed for *C. drummondii* has been noted for many elements of the American flora; *C. drummondii* was cited as an example in this connection by Bray (1900). This entire question was reviewed by Raven (1963), who concluded that such disjunction of xerophytes probably occurred by dispersal from South America to North America in relatively recent time. The distribution of *C. drummondii* accords with this interpretation because: (a) the center of dispersal (or "source") of this group is South American, so that it is more reasonable to suppose that propagules were disseminated from south to north rather than in the opposite direction; and (b) the plants of this species from the two areas are scarcely distinguishable, a factor that suggests

that the disjunction is of relatively recent origin. The only apparent distinction is that the petal spot may be present or absent in the South American specimens but is uniformly absent in the Texas specimens, a variability pattern which further supports the idea of a southern origin.

The distribution of *C. digitata* provides a second example of disjunction in *Cienfuegosia*. The species occurs from southern Angola to the Transvaal in South Africa and from Mauritania to northern Nigeria in northwestern Africa. Hutchinson (1947) stated that the area of the greatest variability of *C. digitata* is in the southern part of its range, and that this is therefore its primary distribution; the more northerly distribution is the result of secondary colonization. I find no such difference in variability. On the basis of the distributional data, implying an American origin and a transatlantic crossing, I prefer the opposite conclusion: that the West African distribution is primary and the South African distribution secondary. The distributional disjunction of *C. digitata* is somewhat parallel with the disjunct distribution of *Gossypium anomalum* in roughly the same areas of Africa, as noted by Pearson (1954) and discussed by Fryxell (1967b). Perhaps those more familiar with the flora of Africa might add additional examples and proffer a phytogeographic interpretation. The lack of morphological divergence between the disjunct populations, both in *C. digitata* and *G. anomalum*, suggests that the disjunction is of relatively recent origin.

The parallel with *G. anomalum* is noteworthy in another way. The other taxa closely allied to *C. digitata* occur in America. Thus, the distribution of the entire group spans the Atlantic. Similarly, taxa closely allied to *G. anomalum* have recently been described from the Cape Verde Islands; this indicates a distributional extension into (if not across) the Atlantic. These distributional data are particularly significant because this species group or its near relatives have been suggested as possible ancestors of the amphidiploid species of *Gossypium* (see Phillips, 1963). The strong distributional parallel that exists between the taxa allied to *C. digitata* and those that are allied to *G. anomalum* may suggest additional clues to the phylogenetic history of *Gossypium*.

The most primitive (as well as the least known) of the six species in sect. *Cienfuegosia* appears to be *C. subternata*, which is endemic to Paraguay. The Ecuadorian-Peruvian *C. tripartita* is apparently derived directly from it. An expansion or migration northward along the Pacific coast of South America is indicated. The Mexican *C. rosei* may be a specialized derivative of this line. The African *C. digitata* and *C. heterophylla* from Colombia, Venezuela, and Brazil, appear to constitute a separate phylogenetic line; this suggests a migration northward along the Atlantic side of South America, and, indeed, across the Atlantic. The insular *C. yucatanensis* is a specialization of *C. heterophylla*. The overall picture indicates an expansion from a center in or near Paraguay northward as far as Yucatan and southern Florida and eastward across the Atlantic. The pattern of distribution of *C. yucatanensis* suggests that it was achieved via salt-water dissemination to coastal and insular sites. Perhaps *C. digitata* was disseminated across the Atlantic by the same means. The transatlantic migration presumably occurred earlier than the African migration that gave rise to the present-day disjunction in the distribution of this taxon.

REPRODUCTIVE BIOLOGY

All species of *Cienfuegosia* are self-compatible, as far as is known, except for the dioecious *C. heteroclada*. Dioecy is confined to this single species in *Cienfuegosia* but is known elsewhere in the *Gossypieae* in *Hampea*, and elsewhere in the *Malvaceae* in *Kydia* and *Napaea*. In subg. *Articulata* self-pollination occurs easily and presumably regularly (except perhaps in *C. gerrardii*) because the decurrent stigma is in close proximity to the androecium. The showy corolla is clearly an adaptation for attracting insects. That cross-pollination also occurs regularly, therefore, seems likely.

In subg. *Cienfuegosia* the basic (primitive) pattern shows a capitate, greatly exerted stigma; thus self-pollination is probably infrequent. This basic pattern has evolved in two directions, both of them involving a reduction in relative style length. The first departure from the basic pattern is found in some species of sect. *Cienfuegosia* which have decurrent stigmas similar to those in subg. *Articulata* and in *Gossypium*. The clavate style with decurrent stigmatic lobes that only partially exceed the androecium (expressed in most extreme form in *C. heterophylla*) is clearly an adaptation for increased self-pollination. An overall decrease in flower size accompanies this adaptation.

The second departure from the basic pattern occurs principally in *C. sulfurea* and *C. argentina*, of sect. *Paraguayana* and sect. *Friesia*, respectively. In these species, the upper portions of the style branches are free and partially recurved, so that the stigmatic lobes are brought nearer to the androecium, thus enhancing the possibility of self-pollination. In these same species the petal spot is less prominent, and facultative cleistogamy occurs.

The corolla is bright yellow in all taxa of subg. *Cienfuegosia* (except that it is pale yellow to white in *C. tripartita* and in *C. rosei*). There is a dark spot at the base of each petal in all taxa, except that the spot is small in *C. argentina*, vestigial in *C. sulfurea*, absent in *C. yucatanensis*, and sometimes absent in *C. drummondii*.

Flowering is diurnal in *Cienfuegosia*. The flower generally opens in early morning and withers later in the same day. In some species the flowers close by noon, in others not until late in the afternoon. The corolla, with the androecium attached, falls the next day. Three species, *C. somaliana*, *C. welshii* and *C. hearnii* (and possibly also *C. chiarugii*) are exceptional in that their flowers do not open until midday, then close later in the afternoon.

Facultative cleistogamy occurs in *C. drummondii*, *C. sulfurea*, and *C. argentina*, but has not been observed in the other species that are in culture. I tentatively suggest that the phenomenon is confined to the sections *Friesia* and *Paraguayana*. Cleistogamic flowers (which readily produce fruits and seeds) apparently develop in response to environmental factors such as shading. Such flowers are greatly reduced in size (and sometimes number) of parts and have been illustrated by Fryxell (1963). Facultative cleistogamy also occurs in a few species of *Gossypium* and in many species of *Hibiscus* (Fryxell, 1963 and unpublished; F. D. Wilson, personal communication).

The flowers of *Cienfuegosia* are generally campanulate, narrowly so in *C. hearnii*. However, in *C. yucatanensis* the petals flare widely to a fully rotate form.

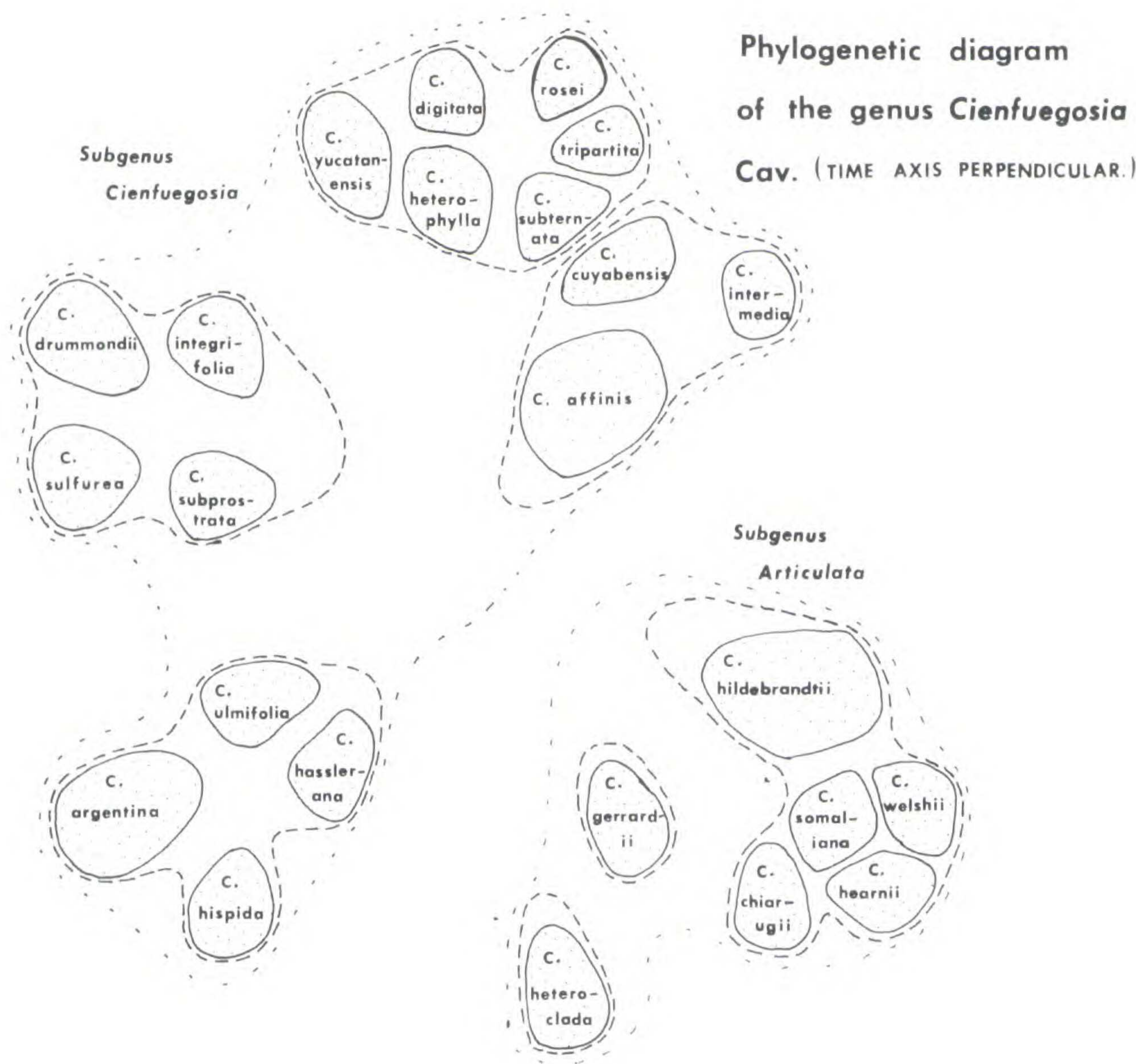


Fig. 6. Phylogenetic diagram of *Cienfuegosia*.

PHYLOGENY

The postulated phylogeny of the genus is illustrated diagrammatically in Fig. 6. Each of the two subgenera of *Cienfuegosia* is considered to be monophyletic, but whether the two groups had a common origin is not clear.

The premises upon which the discussion of specific phylogenetic lines is based appear in Table 1.

Table 1. Primitive and advanced traits in *Cienfuegosia* Cav.

Trait	Primitive	Advanced
Growth habit	Large and shrubby	Small and herbaceous
Pollination adaptations	Outbreeding	Inbreeding
Petal spot	Present	Absent
Stigma	Exserted from androecium	Included in androecium
Flowering branches	Complex	Reduced
Capsule	Pubescent	Glabrous
Pigment glands	Extended to all parts	Restricted to certain parts
Number of seeds per locule	Many	Few

In subg. *Articulata*, *C. gerrardii* from South Africa is the most primitive representative, as indicated by: its large size and shrubby growth habit; its many-jointed fruiting branches; its more widely distributed pigment glands; and its flower structure that favors outbreeding. Hutchinson (1959) drew attention to the phylogenetic position of this species. (Although it has many primitive traits, *C. gerrardii* exhibits an advanced character in its reduced seed number.) The more complex fruiting branches of *C. gerrardii* have become reduced in two distinct evolutionary lines, while remaining articulated and sometimes several-flowered. One line is represented by the highly specialized *C. heteroclada*, occurring in northern Nigeria and Ghana, which develops many-flowered racemes. The other line includes the shrubby *C. hildebrandtii* from eastern and southeastern Africa and the subshrubs *C. chiarugii*, *C. somaliana*, *C. welshii*, and *C. hearnii* from Somalia, Ethiopia, and Aden. In most of these species the flowers are borne singly on articulated peduncles in the axils of the leaves (sometimes more than one in *C. welshii* and *C. hildebrandtii*). This pattern of two evolutionary lines suggests an expansion from south to north. The amount of divergence among the species of this subgenus, including the development of dioecy in one species, indicates that the group is ancient.

In subg. *Cienfuegosia*, sect. *Robusta* is the most primitive group and *C. affinis* is the most primitive species. It is a large, woody shrub with peduncles that are sometime articulated and even (rarely) several-flowered. The flowers are large and clearly adapted to outbreeding, with long styles (nearly equaling the petals) and capitate stigmas. Moreover, *C. affinis* shows the greatest similarity to species of sect. *Articulata*, notably in peduncle articulation and in the more widespread distribution of pigment glands, especially in the corolla. *Cienfuegosia gerrardii* and *C. affinis*, the two species interpreted as the most primitive of their respective subgenera, both have hairy fruits.

Cienfuegosia cuyabensis and *C. intermedia* are intermediate between *C. affinis* and species of sect. *Cienfuegosia* and thus represent transitional forms to or offshoots of this evolutionary line. *Cienfuegosia subternata* is the next step in this series as the most primitive of the six taxa included in sect. *Cienfuegosia*. The distributional and phylogenetic relationships among the six species in this section (noted on p. 183), involve one development that leads to *C. tripartita* and *C. rosei* and another to *C. heterophylla*, *C. yucatanensis*, and *C. digitata*. Hutchinson (1947) referred to a cline in leaf shape in these species but failed to account for the geographical relations among these plants.

The flower form of *C. affinis* (including such features as the long style, the large corolla, and the prominent petal spot with its characteristic yellow radii) can be traced to at least one element in each of the other sections of subg. *Cienfuegosia*. These examples are: (1) *C. subternata* of sect. *Cienfuegosia*, as already noted; (2) *C. ulmifolia* of sect. *Friesia*; and (3) *C. subprostrata* of sect. *Paraguayana*. The last named species also shares with *C. affinis* the sericeous vestiture of the fruit that is not found elsewhere in the subgenus. Because of this relationship, these species are considered to be the most primitive representatives of their respective sections. Phylogenetic relationships of sections *Friesia* and *Paraguayana*, however, cannot be clearly inferred.

The four species of sect. *Friesia* are closely allied morphologically and do not exhibit any noteworthy phylogenetic series. *Cienfuegosia ulmifolia* is probably the most primitive representative; *C. hasslerana* is closely related to it; *C. hispida* and *C. argentina* are apparently more highly specialized.

The four species of sect. *Paraguayana* are more divergent among themselves than those of sect. *Friesia*; *C. subprostrata* and *C. integrifolia* are closely allied and relatively more primitive, while *C. drummondii* and *C. sulfurea* are more specialized. In both of these sections the more primitive species are distributed in or near the proposed center of origin of the subgenus, Paraguay, while the derived species have distributions that extend beyond this center to the south and west.

As in subg. *Articulata*, the great divergence among the species of subg. *Cienfuegosia* indicates that the group is ancient.

CHROMOSOME COUNTS

Previously published information on the chromosome numbers of *Cienfuegosia* is meager, Youngman (1931, p. 54) published a somatic (?) chromosome count of 26 for *C. hildebrandtii*, which is identical to the numbers reported for *Gossypium*, *Thespesia*, and *Hampea*. However, Skovsted (1935, p. 287) later published a count of $2n = 22$ for the same species, and Palacios and Tiranti (1966) and F. D. Wilson (unpublished) confirmed the latter number.

Longley (1933, p. 224) reported $2n = 20$ for *C. heterophylla*. He described the plant as "*C. heterophylla* (Vent.) Garcke, a species native to the southern part of the United States, . . ." Presumably, his material came from the Florida Keys and in fact represents *C. yucatanensis* Millsp.

Palacios and Tiranti (1966) published values of $n = 10$ for three Argentine species, *C. sulfurea*, *C. drummondii*, and *C. ulmifolia*.

Living material is available for study of twelve taxa, and additional counts have been made as given in Table 2.

Table 2. Chromosome numbers in *Cienfuegosia*.

Species	Gametic chromosome number	Authority ¹
<i>C. hildebrandtii</i> Garcke	11	Skovsted (1935); Palacios & Tiranti (1966)
<i>C. welshii</i> (T. Anders.) Garcke	11	Wilson (Unpubl.)
<i>C. hearnii</i> Fryx.	11	Wilson (Unpubl.)
<i>C. somaliana</i> Fryx.	11	Wilson (Unpubl.)
<i>C. digitata</i> Cav.	10	Wilson (1968)
<i>C. heterophylla</i> (Vent.) Garcke	10	Wilson (1968)
<i>C. yucatanensis</i> Millsp.	10	Longley (1933)
<i>C. tripartita</i> (H.B.K.) Garcke	10	Wilson (1968)
<i>C. rosei</i> Fryx.	10	Wilson (Unpubl.)
<i>C. affinis</i> (H.B.K.) Hochr.	10	Wilson (Unpubl.)
<i>C. sulfurea</i> (Juss. in St.-Hil.) Garcke	10	Palacios & Tiranti (1966)
<i>C. drummondii</i> (A. Gray) Lewt.	10	Palacios & Tiranti (1966)
<i>C. argentina</i> Gürke	10	Wilson (Unpubl.)
<i>C. ulmifolia</i> Fryx.	10	Palacios & Tiranti (1966)

¹ The unpublished data of F. D. Wilson cited in this table were graciously provided by Dr. Wilson from a manuscript in preparation dealing with the karyology of *Cienfuegosia*.

HYBRIDIZATION

Twelve of the twenty-four taxa included in *Cienfuegosia* are currently available in the living state for experimental study. Many interspecific crosses have been attempted in this group in order to assess genetic relationships. The following crosses have been successful:

- C. welshii* X *C. hearnii*
- C. digitata* X *C. heterophylla*
- C. yucatanensis* X *C. heterophylla*
- C. yucatanensis* X *C. digitata*
- C. yucatanensis* X *C. tripartita*
- C. heterophylla* X *C. tripartita*
- C. argentina* X *C. affinis*
- C. sulfurea* X *C. drummondii* (lethal as seedlings—Palacios and Tiranti, 1966)

Additional crosses are being made. The results of these experimental studies will be reported elsewhere.

SYSTEMATIC TREATMENT

- Cienfuegosia* Cav., Diss. 3: 174., t. 72., f. 2, 1787.
- Fugosia* Juss., Gen. Pl. 274, 1789, pro syn.
- Cienfugiosa* Gis., Prael. (Linn.) 471, 1792.
- Cienfuegia* Willd. in L., Sp. Pl. ed. 4. 3: 723, 1800.
- Redutea* Vent., Hort. Cels t. 11, 1800.
- Redoutea* H.B.K., Nov. Gen. Sp. Pl. 5: 293, 1822.
- Cienfugosia* DC., Prodr. 1: 457, 1824.
- Elidurandia* Buckl., Proc. Acad. Sci. Philadelphia 1861: 450, 1862.

Perennial herbs or subshrubs (sometimes shrubs) with herbaceous to woody stems arising from a woody rootstock. Stems procumbent (but never repent), lax and ascending, or upright; glabrous to pubescent, commonly angled, usually punctate. Leaves entire or coarsely serrate to variously divided, sometimes deeply and secondarily so; linear, elliptic, cuneiform, reniform, or divided digitately; pubescent to glabrous; sometimes punctate; foliar nectaries present (subg. *Articulata*) or absent (subg. *Cienfuegosia*). Phyllotaxy variable, including 2-, 3- and 5-ranked arrangements. Petioles often canaliculate, glabrous to densely pubescent, often with pubescence confined to distal end. Stipules large and foliaceous (sometimes clasping) to minute and subulate; glabrous to pubescent; caducous or persistent. Peduncles axillary; usually uniflorate although sometimes multiflorate, with or without articulation, trigonal, incrassate above, surmounted by three involucrel nectaries or these lacking. Involucrel sometimes wanting, but usually present, persistent, and 9-12-foliolate (except reduced to 3-foliolate in *C. heteroclada* and partially so reduced in *C. somaliana*); bractlets minute, subulate (and in 3 groups in subg. *Articulata*) or prominent and linear to spatulate, equaling the calyx. Calyx gamosepalous, 5-lobed, usually punctate, glabrous to densely pubescent, sometimes costulate; lobes long-acuminate to rotund-apiculate. Petals 5, distinct, sometimes punctate, stellate-pubescent without, usually showy, yellow (sometimes nearly white), pink, or purple, with dark basal spot (sometimes lack-

ing); flowers withering in a day, sometimes cleistogamic. Anther mass globose, oblate, elliptic, or obovate; staminal column yellowish or dark red, sometimes punctate; stamens sometimes 5-ranked; anthers unilocular, dark red, orange, or yellow; pollen globose, echinate. Style single, sometimes divided apically, usually elongate so that the stigma exceeds the androecium, sometimes punctate; stigmas 3-5-lobed (or if style divided, stigmas distinct), usually exceeding androecium, decurrent or capitate, dark red or yellowish, sometimes pubescent. Fruit a capsule, usually 3-loculed (sometimes 4-5-loculed), ovoid, globose, sometimes obovoid, or notably elongated (in *C. somaliana* and *C. welshii*), glabrous or weakly to densely ascending-sericeous, usually punctate, sometimes with hairs on inner margin of suture. Seeds 3-8 mm, turbinate, minutely puberulent (in *C. affinis*) to densely comose; hairs tightly appressed (*C. drummondii*), loosely appressed, or patent, light tan to rufous-red, up to 10 mm long. Embryos conduplicate. Cotyledons cuneiform to sub-reniform, obtuse to emarginate, sometimes punctate.

The indumentum is variable; some species are densely pubescent while others are essentially glabrous. Pubescence is generally greater on the under surface of the leaves. Plant hairs (except for those on the seed coat) are usually stellate and vary in size from minute puberulence to hairs 1-2 mm in length. Pubescence is characteristically red-brown in *C. gerrardii*. Where longer hairs occur, they are often reduced from stellate clusters to single, semi-scabrous structures.

Pigment glands are found in all above-ground parts of the plant in a few species and are variably distributed in others. The varying distributional patterns have taxonomic significance, especially in the extension of these glands to the floral parts. The glands are always present on the calyx (except sometimes in *C. hearnii*), although they are often very obscure in species of sect. *Friesia*. Glands of the calyx are especially prominent in sect. *Cienfuegosia*. Hutchinson (1947) described these calyx glands as "confined to a double row along each nerve" and used this as a diagnostic trait to distinguish *Cienfuegosia* from its allied genera, in which he described the calyx glands as "scattered, sometimes absent." Although the calyx glands in *Cienfuegosia* are often oriented in the regular fashion described by Hutchinson (e.g., *C. tripartita*, *C. heteroclada*), they are also quite irregularly placed in certain species (e.g., *C. drummondii*, *C. hildebrandtii*); therefore, it is necessary to reject this trait as diagnostic for the genus. The comparative morphology of the embryos of *Cienfuegosia* spp. (Fryxell, 1968) shows them to bear a marked resemblance to those of *Gossypium*, except that most of the species of *Cienfuegosia* have embryos lacking the dark pigment glands, while only a few of the species of *Gossypium* are lacking them. Type species: *Cienfuegosia digitata* Cav.

ARTIFICIAL KEY TO THE SPECIES OF CIENFUEGOSIA,
BASED ON VEGETATIVE CHARACTERS

- a. Leaves deeply dissected or compound.
 - b. Plants procumbent herbs.
 - c. Leaf segments rounded to obovate, crenate 21. *C. argentina*
 - cc. Leaf segments linear, dentate 24. *C. hasslerana*
 - bb. Plants ascending herbs or subshrubs.
 - d. Foliage odoriferous 4. *C. somaliana*
 - dd. Foliage non-odoriferous.

No previous subgeneric classifications have been proposed in *Cienfuegosia*, although Garcke (1860) separated an American and an African group, and Hutchinson (1947) suggested certain species alliances. Neither author, however, gave taxonomic status to these groups or provided them with a nomenclatural basis. The present treatment divides the genus into two subgenera and seven sections.

KEY TO THE SUBGENERA

- a. Peduncles articulate (sometimes obscurely so at base); flowers solitary or on several-flowered sympodial branches; petals punctate; stigmas decurrent; foliar nectaries usually present; bractlets of involucl in three groups I. *ARTICULATA* (p. 194)
- aa. Peduncles non-articulate; flowers solitary in the leaf axils; petals epunctate (or if peduncles articulate or petals punctate, then stigma capitate); stigmas capitate or decurrent; foliar nectaries lacking; bractlets of involucl not grouped, sometimes lacking II. *CIENFUEGOSIA* (p. 204)

I. SUBG. *Articulata* Fryxell, subgen. nov.

Folia punctata, plerumque cum nectariis infra. Pedunculi articulati. Involucrum breve, saepissime 9-phyllum; foliolata involucrorum tribus in turmis disposita. Petala punctata. Stigmata decurrentia.

Leaves of variable form, punctate, with 0-3 dorsal foliar nectaries. Flowers solitary or on several-flowered sympodial branches. Peduncles articulate, bracteate at articulation, surmounted by 3 prominent involuclal nectaries. Involucl of 9 bractlets arranged in 3 groups (or these reduced to 3), each group surmounting an involuclal nectary (or nectaries absent in sect. *Dioica*); bractlets inconspicuous, triangular or subulate, persistent. Calyx punctate (punctae sometimes restricted in distribution, or lacking); lobes acute or rotund-apiculate. Petal punctate, yellow, purple, or cream-colored with dark spot on claw. Stigmas decurrent, 3-4-lobed. Fruits glabrous or minutely pilose, usually punctate.

Type species: *Cienfuegosia gerrardii* (Harv. ex Harv. & Sond.) Hochr.

The name of this subgenus is chosen in reference to the articulated peduncles that characterize it.

KEY TO SECTIONS OF SUBGENUS *ARTICULATA*

- a. Shrubs; leaves markedly cordate, palmately trilobed, lobes rounded, entire; stipules large, foliose, oblong, sessile; pedicels subtended by foliar leaf. . . 1. *Articulata* (p. 194)
(contains single species: 1. *C. gerrardii*)
- aa. Subshrubs or perennial herbs; leaves cuneate, entire or dentate, sometimes shallowly lobed or deeply dissected; stipules triangular, subulate or auriculate; pedicels subtended by small bracts.
 - b. Leaves cuneiform to flabelliform or reniform, entire, dentate, or dissected; peduncles in axils of leaves, 1-2-flowered; stipules triangular, auriculate or subulate; bractlets of involucl 9 2. *Garckea* (p. 196)
 - bb. Leaves obovate, entire (sometimes apically tridentate); flowers dimorphic, in short racemes appearing before leaves; stipules subulate; bractlets of involucl 3, irregular 3. *Dioica* (p. 203)
(contains single species: 7. *C. heteroclada*)

1. SECT. *ARTICULATA*

Cienfuegosia subg. *Articulata* Fryx. sect. *Articulata*

Leaves profoundly cordate. Stipules prominent, obtuse, foliaceous. Flowers borne on sympodial fruiting branches. Peduncle articulated, bearing foliar leaf at articulation.

Type species: The type of sect. *Articulata* is the type of subg. *Articulata*, *C. gerrardii*.

- 1. *Cienfuegosia gerrardii* (Harv. ex Harv. & Sond.) Hochr., Ann. Cons. & Jard. Bot., Genève **6**: 56, 1902.

Fugosia Gerrardi Harv. ex Harv. & Sond., Fl. Cap. 2: 588, 1862 [Type: Ladysmith, Natal: *Gerrard* 632 (TCD-n.v.)].

Thespesia Rehmannii. Szyszl., Polypet. Thal. Rehmann. 44, 1888 (=Rozpr. Spraw. Posiedzen 17: 136, 1888) [Type: Ladysmith, *Rehman* 7128 (n.v.)].

Illustrations: Fig. 17, d-e; also Wood (1911) t. 563; Janda (1937) Figs. 18, 28, 34; Fryxell (1968) Fig. 3,a.

Branched open shrub; stems upright or lax, weakly ridged to terete, punctate, moderately covered with a minute stellate tomentum having a characteristic red-brown color. Leaves cordate, acute, sub-entire to moderately 3-5-lobed, sparingly pubescent to glabrate, ciliate-margined, 2-3 cm long, usually broader; lobes rotund; foliar nectary single, basal, elongate (1-2 mm). Petioles pubescent, terete, obscurely punctate, about $\frac{1}{2}$ length of lamina. Stipules foliaceous, entire, persistent, elliptic to oblong, obtuse, 1-nerved, cuneate-sessile, pubescent to glabrate, punctate, 1-2 cm long (equaling or exceeding petioles), 3-8 mm broad, symmetrical. Fruiting branches sympodial, several-flowered, articulate and foliate at base of each pedicel. Pedicels $\frac{1}{2}$ -1 $\frac{1}{2}$ cm, puberulent to glabrate, surmounted by 3 large bordered nectaries. Involucel of 9 bractlets in 3 groups; bractlets irregular, subulate (1-3 mm) or occasionally larger (up to 8 mm) and then often spatulate and somewhat foliose, punctate, 1-nerved, glabrate. Calyx 1-1 $\frac{1}{2}$ cm, costulate, puberulent to glabrate; lobes 3- (rarely 5-) ribbed, triangular, acute (sometimes rounded, sometimes acuminate, rarely 1-toothed), 4-7 mm long. Petals yellow, 2-3 $\frac{1}{2}$ cm with small dark-red spot on claw (spot sometimes lacking). Anther mass globose to obovoid; filaments 2-4 mm, reddish [in sicco]; androecial column and occasionally the filaments sparingly punctate; anthers red; pollen light-colored. Style markedly punctate, exceeding androecium; stigma 3-lobed. Fruit 3-loculed, globose to obovoid, 1-1 $\frac{1}{2}$ cm, rostrate, short-pilose without, glabrous within. Seeds one per locule, 8 mm long, 5 mm wide, oval in outline, soft-pubescent; seed hairs dense, brown, $\frac{1}{3}$ mm. Embryo punctate.

Distribution (Fig. 7): Transvaal: in the region of Lydenburg and Middleburg; Swaziland; Natal: nearly to the coast, and as far south as the Umzimkulu River; Mozambique: west of Laurenço Marques (Excell and Wild, 1961).

Marshall, Parson, and Hutchinson (1937) note that the ecological distribution of this species in South Africa and Swaziland is confined to the middle veld district, which is defined roughly as the area included within 2000 to 4000 feet elevation. The plant occurs "in colonies growing in scanty soil in the hilly ground above 1400 ft."

SOUTH AFRICA: NATAL: Zululand: *Gerrard* 257 (BM); Magul, Ngotsche, *Parsons* s.n., Dec 1925 (PRE); Port Natal, *Gerrard & McKen.* s.n. (S- this specimen is incorrectly denoted as the type); Camperdown, 2000 ft, *Wood* 239 (LE), 11722 (PRE); *Haygarth* s.n., 1883 (BM). Griqualand East: In clivis pr. "Clydesdale" ad flum. Umzimkulu, 2500 ft, *Tyson* 1408 (G, Z). TRANSVAAL: Lydenburg, *Wilms* 83 (BM, G, L, M, P, PH), 4800 ft, *Schlechter* 3950 (G, M, UC, Z); outside village on Farm Rovidraai, open scrub in riverbank $\pm$ 4800 ft, *Liebenberg* 3492 (PRE); procumbent on riverbank, 4700 ft, *Galpin* 12193 (PRE), *Rogers* 14561 (Z); Kruger National Park, Pretoriashap, 2000 ft, v. d. *Schijff* 2076 (PRE); Middleburg, *Wilms* 83b (G, L), *Kassner* 121 (BR); bei Brankhorst-Spruit, *Wilms* 83a (BM, Z).

SWAZILAND: Bremersdorp, *Hutchinson* 5 (PRE).

2. SECT. **Garckea** Fryxell, sect. nov.

Folia cuneiformia vel reniformia, simplicia vel dissecta. Stipulae magnae etiam auriculatae-acuminatae, aut parvae et subulatae. Pedunculi plerumque axillares, articulati, squamis parvulis ad articulos.

Subshrubs. Stems glabrous to pubescent, weakly angular, punctate, often obscurely so. Leaves cuneiform to reniform, entire (except sometimes dissected in *C. somaliana*) or sometimes 3-lobed, dentate- or serrate-margined on upper portion, punctate (sometimes translucently so), glabrous to pubescent. Foliar nectaries 0-3. Petioles glabrous, puberulent, or scabrous, punctate, usually canaliculate. Stipules large and clasping or inconspicuous and subulate. Flowers 1 or 2 (rarely more) on axillary peduncles or short sympodial branches. Peduncles articulate, with much-reduced bract at articulation, surmounted by 3 involucrel nectaries. Involucrel of 9 bractlets in 3 groups, each group usually surmounting a nectary; bractlets subulate, sometimes laterally connate. Calyx costulate (except in *C. chiarugii*), splitting and pseudo-bilabiate in flower and fruit; lobes rotund-apiculate, 3-5-ribbed. Petals yellow, purple, or cream-colored, with dark claw. Androecium purple or orange; pollen cream-colored or orange. Fruit prominently or obscurely punctate, glabrous to minutely pilose, ovoid to slightly obovoid or greatly elongated. Type species: *Cienfuegosia hildebrandtii* Garcke.

Chiovenda (1929) published *C. chiarugii* and established the section *Synodontos* to include that species, but did not provide a diagnosis for the name. Moreover, he based the section on (and derived its name from) a single trait, a gamophyllous involucrel, which *C. chiarugii* does not possess. This name cannot be accepted as valid because the *descriptio generico-specifica* pertains only to monotypic genera (Article 42). Section *Synodontos* is not monotypic and was not considered to be by Chiovenda. It is possible to validate Chiovenda's name by providing the necessary diagnosis, but since the name was descriptively ill-chosen, it is considered preferable to publish a new name not encumbered with a misconception. Such a course is not in violation of Article 62 since the name *Synodontos* was not validly published.

The name *Garckea* is chosen to honor A. Garcke, who made the first significant evaluation of *Cienfuegosia* (1860) and who later described the type species of this section.

KEY TO SPECIES OF SECTION GARCKEA

- a. Stipules prominent, auriculate-clasping; foliar nectaries 3, basal; petals yellow; androecium orange 2. *C. hildebrandtii*
- aa. Stipules inconspicuous, subulate; foliar nectaries 1-3, medially positioned, sometimes absent; petals yellow, cream, or purple; androecium purple.
 - b. Petioles as long as lamina or longer, puberulent or scabrous, especially at distal end; plant puberulent or pubescent (at least on petioles); petals yellow or cream.
 - c. Leaves reniform, denticulate, sparsely scabrous below and on petiole, non-odoriferous, 5-ranked; foliar nectaries 3; peduncle exceeding leaves, articulated near center; petals cream 3. *C. welshii*
 - cc. Leaves flabelliform, slightly 3-lobed to deeply dissected, dentate, minutely puberulent on margin and petiole, odoriferous, 3-ranked; foliar nectary 1 (-3 or rarely 0); peduncle shorter than leaves, articulated basally; petals yellow 4. *C. somaliana*

- bb. Petioles shorter than the lamina, glabrate; plant essentially glabrous; petals purple.
 - d. Leaves obovate; calyx ecostulate, prominently punctate; foliar nectaries lacking 5. *C. chiarugii*
 - dd. Leaves cuneiform, odoriferous; calyx costulate, punctate or epunctate; foliar nectaries 1-3 6. *C. hearnii*

2. *Cienfuegosia hildebrandtii* Garcke, Eichl. Bot. Jahrb. Bot. Gart. Berl. **2**: 337, 1883 [Holotype: Txamtei in Duruma. Im Gras auf salzigem Boden, *Hildebrandt* 2325 (probably B[†]). Neotype: Tanzania: Lushoto District: 3 miles NW of Mombo, 29 Apr. 1953, *Drummond & Hemsley* 2285 (BR, isoneotypes: B, FI)].

Illustrations: Fig. 17, a-c; also Marshall, Parson, and Hutchinson (1937) Figs. 1-3; Exell & Wild (1961) t. 85; Fryxell (1968) Fig. 3,b.

Small, branched, upright shrub. Stems usually minutely pubescent, sometimes glabrous, terete. Leaves broader than long, cuneate, flabelliform, unlobed to weakly trilobed, irregularly dentate, 3-nerved, glabrate above, sometimes minutely pubescent below, ciliate-margined. Foliar nectaries 3 (rarely lacking), basal. Petioles about $\frac{1}{3}$ length of lamina, densely pubescent throughout to moderately pubescent on upper surface only. Stipules auriculate-clasping, asymmetrical (rarely lanceolate, symmetrical), acuminate, entire, pubescent or glabrate, ciliate-margined, 6-10 mm long ($\frac{1}{2}$ - $\frac{2}{3}$ length of petiole) rarely longer, half as broad. Peduncles solitary (rarely multiple), equaling or barely exceeding petiole, articulate and bracteate near center, punctate, often pubescent, nectaries prominent. Involucel bractlets 1-3 mm, central bractlet of each group often exceeding lateral bractlets, rarely partially connate. Calyx 7-10 mm, sparingly punctate (often only at base of tube) to nearly epunctate, costulate, scarious in intercostal areas, glabrous or pubescent; lobes shallow, 3-ribbed, rotund-apiculate. Petals 3-4 cm (rarely smaller), sparingly punctate, yellow with large dark-red spot on claw. Androecial column pallid, punctate; filaments dark-red; anther mass globose; anthers unranked, orange; pollen orange. Style epunctate, exceeding androecium; stigma dark-red, pubescent. Fruit ovoid to obovoid, obscurely punctate, glabrous to weakly pilose, 3-4-loculed, 10-14 mm long. Seeds turbinate, 5-6 mm long, densely comose; hairs 8-10 mm, straight, soft but appearing bristly, red-brown to dirty-tan color. Embryo epunctate, but with reddish punctae developing on mesocotyl and cotyledonary margins upon germination. Chromosome number: $n = 11$.

The variation in vestiture that is characteristic of this species can be noted even on individual collections. For example, both glabrous and pubescent branches occur among the duplicates, even on a single sheet, of *Schlechter* 11770 (Z).

Hochreutiner separated two branches of the collection of *Braga* 82 (Z), differing in pubescence, as distinct varieties in manuscript names. I do not believe that a varietal distinction based on pubescence is warranted because: (a) there is no correlated variation in other traits, and (b) there seems to be no geographical basis for the distinction. Therefore, the varietal epithets suggested by Hochreutiner shall herein remain unrecognized.

Distribution (Fig. 8): Natal, Swaziland, and the Transvaal in the south northward along the eastern coast of Africa to central Mozambique. It also occurs in Tanzania, but according to Pearson (1954) is absent between there and central Mozambique. Specimens were cited by Gonçalves (1963) from southern and central Mozambique; Marshall, Parson, and Hutchinson (1937) cited its occurrence in Southern Rhodesia, northern Mozambique, and southern Tanzania, indicating a relatively continuous distribution. These localities are included in the distribution map since there appears to be no question of the identity of the plants concerned. In the southern part of its range, where it overlaps the range of *C. gerrardii*, it is separated ecologically from this species, occurring at lower altitudes. Ulbrich (1914) asserted that *C. hildebrandtii* occurs in Madagascar, but no specimens from there are known to me.

Marshall, Parson, and Hutchinson (1937) gathered important ecological data on the distribution of *C. hildebrandtii*, at least in the southern portion of its range, which Pearson (1954) indicated to be its principal distribution. They found it to occur in close association with *Acacia barbertonensis* Schweick. at altitudes below 1300 feet, to be absent from areas with "thin, stony soils," and to be present in regions of "better and deeper soils." They divided the habitats in which *C. hildebrandtii* occurs into three types: "(a) the crests and sloping sides of low elevations, (b) along water channels, and (c) pans (*vleis*)." (The last named are depressions often characterized by impermeable (saline?) soil, vegetated only on the margins.) They noted that the occurrence of the plant on the water channels and pans is "consequent on proximity to watercourses" and drew particular attention to the dissemination of seeds by water, since their bristly vestiture renders them buoyant.

However, *C. hildebrandtii* occurs primarily on the crests of low hills having good soil cover. Water-borne dissemination does not account for this occurrence. The seeds of this species have bristly hairs that stand straight out, and thus appear to be well-adapted to wind-transport (as a tumbleweed). The seeds drop from the plant very quickly upon maturation, and will germinate with the first adequate rainfall, since they apparently have no dormancy. Plants have an extensive root system, which can reach layers of permanent moisture (Marshall, Parson, and Hutchinson, 1937). These characteristics seem to account for the primary hilltop distribution. The capacity of this species for wind dissemination may also account for its greater range, as compared to the other species in subg. *Articulata*. *Gossypium australe* F. Muell., native to arid areas of Australia, may have been disseminated in a similar manner (Fryxell, 1965).

SOUTH AFRICA: NATAL: Zululand: Ntambanana, *Taylor s.n.* (PRE); 9 mi from Hluhluwe, Reserve gate, Hlabisa rd, *Wells* 2048 (PRE); Umfolosi Game Reserve, 600 ft alt, *Ward* 3240 (PRE), *Edwards* 3298 (PRE); Ingwauuma, red sand nr vley, *Strey* 4757 (PRE). TRANSVAAL: Barberton Distr.: Komati Poort, alt 1000 ft, *Schlechter* 11770 (BM, BR, G, L, LE, MO, P, S, US, Z), *Rogers* 12624 (Z), 22389 (Z); Lebombo Flats, *Strey* 4028 (PRE); Kruger National Park, Nelspruit, 5½ mi N of Malelane, 1000 ft, *Codd* 5229 (PRE); Skukuza, on brackish land, 1000 ft alt, *v. d. Schijff* 3409 (MO), 3938 (PRE).

SWAZILAND: Stegi to eastern foot of Lubombo, *Burt-Davy* 10572 (PRE); Bremersdorp, *Wood s.n.*, 25 Apr 1927 (PRE); Sipofaneni, *Murdoch* 123 (TAES).

MOZAMBIQUE: SUL DO SAVE: Sabie, Moambo, *Pedrogão* 27 (LIL), 225 (LIL); Moamba, *Harland s.n.*, 1930 (C); Umbeluzi, *Borle* 257 (BM), 551 (PRE), *Lemos* 127 (LIL). Marracuene, *Pedro & Pedrogão* 643A (LIL-p.p.), 663 (LIL); *de Carvalho* 219 (BM);

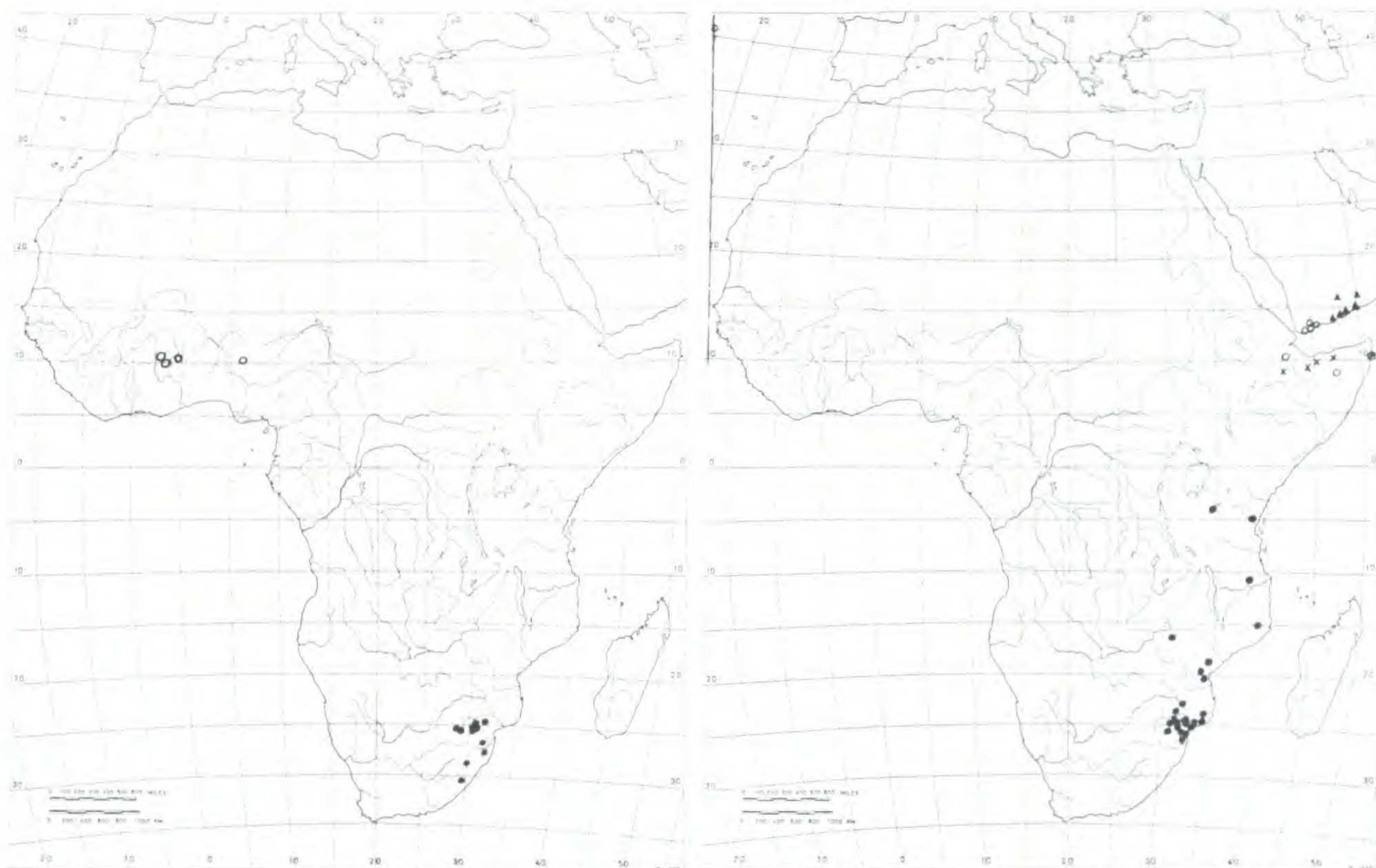


Fig. 7. Distribution of *C. gerrardii* ● and *C. heteroclada* ○. Fig. 8. Distribution of *C. hildebrandtii* ●, *C. chiarugii* ⊙, *C. somaliana* ×, *C. welshii* ○, and *C. hearnii* ▲.

Boane, *Braga* 82 (Z); Guijá, *Pedro & Pedrogão* 2114 (LIL); Goba, *Wood* 6828 (PRE); bei Pisini zwischen Lebombo und Delgao Bai, *Schenck* 825 (Z); *Myre & Balsinhas* 1663 (BM).

TANZANIA: LUSHOTO DIST.: 3 mi NW of Mombo, on waterlogged soil, alluvial plain, 425 m, *Drummond & Hemsley* 2285 (B, BR, FI).

IN CULTIVATION: *Fryxell* 14001 (ARIZ, TAES); *Fryxell* 14007 (provenance: Sipofaneni, Swaziland) (TAES).

3. *Cienfuegosia welshii* (T. Anders.) Garcke, *Eichl. Bot. Jahrb. Bot. Gard. Berl.* **2**: 337, 1883 (as *C. Welshii*).

Hibiscus Welshii T. Anders., *Jour. Linn. Soc., London* **5** (Suppl. 1): 8, 1860 [Type: Aden, rarissime: *Hook, f. & T.* (K-n.v.)].

Fugosia Welschii Hochr., *Ann. Cons. & Jard. Bot., Genève* **4**: 174, 1900.

Illustrations: Fig. 18, d-g; also *Anderson* (loc. cit.) t. 1; *Janda* (1937) Figs. 27, 33; *Fryxell* (1968) Fig. 3,c.

Upright subshrub from woody rootstock. Stems woody, glabrous, punctate. Leaves 5-ranked; 5-veined, reniform, slightly 3-lobed, denticulate, glabrous (sometimes sparingly scabrous on veins), about twice as broad as long, punctate; punctae often more prevalent on veins (below) and as marginal row. Foliar nectaries 3, medially to sub-apically positioned. Petioles as long as or longer than lamina, canaliculate, scabrous especially on upper side (hairs 1/2-1 mm) or sometimes glabrate in age. Stipules inconspicuous (1-4 mm), subulate, scabrous. Peduncles 1- (rarely 2-) flowered, articulate and with small bract near center, glabrous,

punctate, often exceeding leaves (1-7 cm), nectaries large. Involucel bractlets 1-2 mm, glabrous, punctate, central bractlet of each group often exceeding lateral bractlets. Calyx $\frac{1}{2}$ -1 cm, minutely pilose to glabrate, costulate, prominently punctate (punctae $\frac{1}{3}$ mm, distributed in rows along veins throughout calyx); lobes shallow, 3-ribbed, apically pubescent within. Petals 2-3 cm, pale yellow or cream-colored with dark-maroon basal spot covering $\frac{1}{3}$ of petal, sparingly punctate. Androecium epunctate, dark maroon, anther mass globose; pollen yellowish. Style epunctate, exceeding androecium; stigma dark purple, pubescent. Fruit 3-4-loculed, prominently punctate (punctae $\frac{1}{3}$ mm diam.), minutely and sparsely pilose without, glabrous within, elongate (7-10 mm broad, 12-30 mm long). Seeds 4-5 mm, copiously hairy; hairs fulvous, loosely appressed to nearly straight, to 8 mm. Embryo epunctate, but with pinkish punctae developing on mesocotyl and translucent punctae developing as a single marginal row on the cotyledons upon germination. Chromosome number: $n = 11$.

The vernacular name "*Blambal*" is recorded on Gooding's specimen from Somalia, and Hearn (1968) notes that in southern Yemen the term "*atab baladi*" (cotton of the country) is applied to *Cienfuegosia* spp. as well as *Gossypium* spp.

Distribution (Fig. 8): This species occurs under very arid circumstances in Aden, as well as in Somalia below 700 m. Brettell (1966) states that *C. welshii* "is to be found in some profusion" in the Jebel Sirah range of mountains just to the east of Dirgag. Hearn (1968) cites additional locations and indicates its altitudinal range to be up to several hundred meters above sea level. Hutchinson (1947) noted a greater range of variability, at least in leaf form, in material from Somalia, which he retained in *C. welshii*. Examination of the specimens, however, indicates that specific differences exist in this material that merit taxonomic recognition (Fryxell, 1967a). The separation of the following species (*C. somaliana*) provides this distinction.

SOUTHERN YEMEN (ADEN): Ad fances montis Scham-Scham: *Deflers s.n.*, 3 Apr 1886 (Z), *Deflers* 60 (K, P); Goldmore Valley, *Schweinfurth* 75 (BM, C, Z); 2 m alt, *Hildebrandt* 780a (BM, LE); *Beccari s.n.*, Mar 1870 (FI); *Waring* 19 (K).

SOMALIA: Los Anod, 2300 ft alt, *Hemming* 2187 (K); Mordale, alt 740 m, *Gooding* 207 (4) (K).

IN CULTIVATION: *Fryxell* 14006 (TAES).

4. *Cienfuegosia somaliana* Fryx., Britt. **19**: 33, 1967. [Type: Gan Libah, Urgo/Jilbadaig, 11 July 1945, *Glover & Gilliland* 1206, (Holotype: K)].

Illustrations: Fig. 18, a-c; also Fryxell (1967a) Fig. 1,g, (1968) Fig. 3,d.

Subshrub with odoriferous foliage. Stems angled, punctate, minutely puberulent (hairs ca. 0.1 mm, often simple) becoming glabrate. Leaves 3-ranked; 3-5-veined, 8-25 mm long, somewhat broader, 3-lobed to deeply dissected, having characteristic musky odor when handled; leaf segments obovate to linear, secondarily divided, dentate, punctate (especially on margins), margins minutely ciliate, otherwise puberulent to glabrate; foliar nectaries 1-3 (or rarely lacking), medial, inconspicuous. Petiole minutely puberulent (most densely so near juncture with lamina) to glabrate, about equaling lamina. Stipules minute (2-6 mm), triangular, puberulent to glabrate, caducous. Peduncles $\frac{1}{2}$ -2 $\frac{1}{2}$ cm, minutely

puberulent to glabrate, punctate, articulate and bracteate near base. Involucel of ca 9 unequal bractlets, imperfectly arranged in 3 groups; bractlets triangular, 2-5 mm, punctate, puberulent to glabrate, central one of each group often longest. Calyx 8-10 mm, costulate, punctate (punctae translucent); lobes shallow, 3-ribbed (intercostal areas scarious), minutely puberulent to glabrate without, sparingly short-pubescent at apices within. Petals 15-25 mm, prominently punctate (punctae dark red), bright yellow with large maroon spot covering basal half. Androecium maroon; anther masses globose; pollen yellow. Styles slender, exceeding androecium and nearly equaling petals, red, epunctate; stigmas decurrent, maroon, glabrous. Fruit ascending-pilose when young, becoming minutely and sparsely pilose at maturity, prominently punctate (punctae $\frac{1}{3}$ mm diam.), 3-loculed, about twice as long as broad. Seeds 5-7 mm, copiously hairy, the hairs nearly straight, tan or brown, 6-8 mm. Embryo light-punctate along cotyledonary margin, punctae darken upon germination, those of the mesocotyl becoming bright red. Chromosome number: $n = 11$.

Distribution (Fig. 8): Somalia: in mountains along northern coast; Ethiopia: in vicinity of Dire Dawa. *Cienfuegosia somaliana* occurs at elevations from 900 m to 1700 m, while *C. welshii* occurs from sea level up to 700 m.

The vernacular name "biei" is recorded on Bally 9674.

As previously noted (p. 189), these plants were included in *C. welshii* by Hutchinson (1947) who referred to a range of variability in leaf form. However, the two taxa that are here distinguished are differentiated by more than variation in leaf form, as is shown in the following tabulation (modified from Fryxell, 1967a, Table 1).

	<i>C. welshii</i>	<i>C. somaliana</i>
Foliage:	Non-odoriferous	Odoriferous
Leaf form:	Broader than long, reniform, denticulate	Slightly broader than long, suborbicular to dissected, dentate
Vestiture:	Scabrous (on stipules, petioles, and underside of leaf)	Minutely puberulent to glabrate
Petiole length:	Greater than lamina	Equaling lamina
Peduncle length:	3-7 cm, medially articulate	$\frac{1}{2}$ -2 $\frac{1}{2}$ cm, basally articulate
Petal color:	Pale yellow with small spot covering lower third of petal, sparingly punctate	Bright yellow with large spot covering lower half of petal, prominently punctate
Stigmas:	Pubescent	Glabrous
Seed length:	4-5 mm	5-7 mm

SOMALIA: GAN LIBAH: Urgo/Jilbadaig, Glover & Gilliland 1206 (K), Golis Range, Glover & Gilliland 1216 (K); on first terrace facing N, 5100 ft, aromatic leaves, Bally 11910 (K). HARGEISA: sandy ground by stream bed, aromatic, 4300 ft, Gillett 4239 (FI, K, P); Fodjor Esc. W of Shiek; 5000 ft, rocky hill slope, lemon scented, Bally 9674 (K); Sirad'ad, Yamhada: nr rd from Erigavo to Mait, W of 19 on Tabah Rd, alt 5500 ft, dry soil on crest of spur, leaves fragrant when crushed, Newbould 716 (K).

ETHIOPIA: Generally dry area, 2 km SE of Dire Dawa, 3000 ft alt, Getahun s.n., 11 Nov 1965 (TAES).

IN CULTIVATION: Fryxell s.n. (provenance: Dire Dawa, Ethiopia) (BM, CTES, TAES).

5. *Cienfuegosia chiarugii* Chiov., Fl. Som. 101, 1929 [Type: Somalia, Costa dei Migiurtini: Altipiano calcareo presso Hafùn, 23 May 1924, *Puccioni & Stefanini* 617 (680) (Holotype: FI)].

Illustrations: Chiovenda (1929) Pl. III, fig. 3 (not Pl. III, fig. 1 as stated by Chiovenda, nor Pl. I, fig. 3 as cited in Index Londonensis.)

Low woody subshrub. Stems glabrous, punctate. Leaves cuneiform-obovate, entire, obtuse to weakly and irregularly undulate apically, glabrous, punctate, almost as broad as long; foliar nectary lacking. Petioles 3-4 mm (ca $\frac{1}{6}$ length of lamina), slightly scabrous near juncture with lamina. Stipules minute (1 mm), subulate. Peduncles 3-4 mm, prominently punctate, glabrate, basally articulate with small scale at articulation (articulation obscured by shortness of structures). Involucel bractlets 1-1½ mm, prominently punctate, glabrate. Calyx 1 cm, ecostulate, prominently punctate (punctae denser toward apices of lobes), becoming torn and pseudo-bilabiate in flower, glabrate without, pilose within (on apices of lobes); lobes short. Petals 1½ cm, punctate.

In addition Chiovenda's description adds: Androecium purple; filaments 6 mm. Style simple; stigma clavate, 3-lobed. Petals violet. The fruits and seeds are unknown.

Chiovenda's complete and generally accurate diagnosis of this species included the description of a gamophyllous involucel and, indeed, emphasized it as a distinctive feature. Moreover, he used this trait as the sole diagnostic feature for sect. *Synodontos*, which he erected to include this species (cf. p. 196). Examination of the type indicates that the involucel is not gamophyllous but is similar to that typical of the genus with bractlets wholly distinct. Chiovenda's description must therefore be amended.

Distribution (Fig. 8): Known only from the type locality, in northeastern Somalia, the only region of Africa beyond 50° east longitude.

SOMALIA: Costa dei Migiurtini: Altipiano calcareo presso Hafùn, *Puccioni & Stefanini* 617 (680) (FI).

6. *Cienfuegosia hearnii* Fryx., Britt. **19**: 33, 1967 [Type: In cultivation, Tempe, Arizona, *Fryxell* 14005 (Holotype: ARIZ, isotypes: LE, SD, TAES, US)].

Illustrations: Fig. 18, h-k; also Fryxell (1967a) Fig. 1, e-f, (1968) Fig. 3, e.

Low perennial subshrub, branches erect, foliage odoriferous. Stems glabrate. Leaves 5-ranked, leathery, rhomboid to subreniform, sometimes weakly 3-lobed, coarsely serrate, undulate to crisped, cuneate to truncate, glabrous, 3-5 nerved, 15-20 mm long, 20-25 mm broad (or smaller under stressed conditions), with characteristic musky odor when handled; foliar nectaries 1-3, median. Petioles 5-15 mm long, scabrous near juncture with lamina, sparingly so elsewhere. Stipules minute (1 mm), sessile, subulate, glabrous, caducous. Peduncle axillary, 5-20 mm, articulate near center or below with small bract at articulation, punctate, glabrous, nectaries large. Involucel bractlets triangular, 2 mm long, punctate. Calyx 7-8 mm, costulate, scarious in intercostal areas, densely to sparingly punctate (sometimes epunctate); lobes shallow, ovate, 3-5-ribbed. Petals 2 cm,

sparingly punctate, dark purple to roseate (rarely pallid) within, greenish margin without (where exposed in bud), very dark spot covering lower third of petal within. Anther mass ellipsoid; staminal column dark purple, punctate; anthers numerous, dark purple; pollen cream-colored to orange. Style yellowish, punctate, exceeding androecium; stigma dark purple, pubescent. Fruit globose or slightly elongated, 1-1½ cm long, 3-4 loculed, rostrate, weakly strigose, punctate. Seeds 5-6 mm long, densely sericeous; hairs creamy-tan, very loosely appressed (nearly straight), up to 8 mm long. Embryo epunctate, but with red punctae developing on mesocotyl and translucent punctae as single marginal row on cotyledons upon germination. Chromosome number: $n = 11$.

The original description of this species, which was based on cultivated material from a single accession, may now be broadened to account for the variation found in a wider range of material. Although the collections cited exhibit an appreciable variability in several traits, they appear to represent but a single taxon.

Four vernacular names are on record for *C. hearnii*. Hearn (1968) refers to the name "*atab baladi*" ("cotton of the country") used for both *Cienfuegosia* spp. and *Gossypium* spp. in Southern Yemen. In addition, collectors' notes record "*Lawa*" (*Thesiger s.n.*), "*Tamrat el Ghanam*" ("sheep browse"), and "*Shejra el Ham*" ("plant of distress"), the latter two from *Maxwell-Darling 94*.

Distribution (Fig. 8): Hearn (1968) states that this species is known from three localities on the southern margin of the Arabian peninsula growing in the coastal littoral and to an altitude of 1000 m. Additional specimens (*Thesiger s.n.* & *Popov et al.* 4236) extend this distribution more than 100 miles inland. This is apparently an environment of extreme aridity.

SOUTHERN ARABIA: HADHRAMAUT: Meifa Hajar, on pebbly plain, alt 50 ft, *Maxwell-Darling 94* (BM), *Guichard 122* (BM); Riyan, *Guichard 122A* (BM); Radum, alt 100 ft, *Hearn 4* (BM); Wad Mahfad, 2000 ft, in gypseous silt of wadi bed, *Popov et al.* 4277 (BM); edge of northern Jol nr Zamuk, 3000 ft, gravelly wadi bed, *Popov et al.* 4236 (BM); Halaya Well, *Thesiger s.n.*, 16 Feb 1946 (BM).

IN CULTIVATION: Tempe, Arizona, *P. Fryxell 14005* (ARIZ, LE, SD, TAES, US).

3. SECT. **Dioica** Fryxell, sect. nov.

Folia cuneata, simplicia vel exigua lobata. Flores dimorphi, in racemis brevibus antequam folia portata sunt. Foliola involucrorum tria.

Plant glabrous. Stems angular, punctate. Leaves simple to weakly lobed, cuneate, entire, with medial to subapical foliar nectaries. Petioles short. Stipules linear, minute. Flowers arising in short racemes from ground level before leaves. Peduncles elongate. Involucral nectaries lacking. Involucel irregular, typically of 3 bracts; each triangular, punctate. Calyx costulate, punctate (punctae prominent, sparse); lobes ovate, apiculate, 3-5-ribbed. Flowers dimorphic. Petals pink, nearly epunctate. Androecium pallid, narrow. Fruit obovoid, glabrous, punctate. Seeds densely comose; hairs straight, rufous-red.

Type species: *Cienfuegosia heteroclada* Sprague. The name of sect. *Dioica* is chosen in reference to the dioecious condition found in its only species.

7. *Cienfuegosia heteroclada* Sprague, Kew Bull. **1907**: 48, 1907 [Type: Northern Nigeria, Kontagora, in the bush after burning, *Dalziel* 122. (Holotype: K-n.v., isotype: G)].

Fugosia heteroclada Sprague, op. cit., 49, pro syn.

Illustrations: Fig. 17, f-g; also Hutchinson & Dalziel (1928) Fig. 112.

Much-reduced subshrub from woody rootstock. Species dioecious. Stems ridged; inflorescence a short raceme, exceeded by vegetative stems. Leaves elliptic to obovate, or sometimes apically 2-3-lobed or 2-5-dentate, glabrous above and below, 3-5-nerved. Foliar nectaries 1-3, the central one near apex of leaf, the laterals near middle. Petioles canaliculate, glabrous, punctate. Stipules 2-5 mm, glabrous. Rachis of inflorescence punctate, glabrous, angular, pallid, pedicels arising from nodes of rachis, bracteate at nodes, 1-3 cm, glabrous. Involucral bracts irregular in form and number; typically 3, each triangular (or sometimes apically lacinate or 2-3-parted, suggesting a fusion of parts), 4-5 mm long, 2 mm broad, glabrous. Calyx infundibular to campanulate, 9-15 mm, glabrous, punctae sometimes confined to tips of lobes, green, sometimes torn in flower; lobes sometimes suffused with purple. Petals 2-3 cm. Androecium 6-12 mm, pallid; filaments 1-3 mm. (Pistillate flowers not seen.) Fruit 18 mm long, ca. 1 cm broad. Seeds ca. 8 mm, hairs ca. 1 cm long.

Emsley (1957) notes the existence of floral dimorphism in this species and states that about 90% of the plants are staminate, 10% pistillate. The illustration presented by Hutchinson and Dalziel (1928) shows a flower with a greatly reduced gynoecium that apparently represents the staminate form. The occurrence of dioecism is unknown elsewhere in *Cienfuegosia*, and occurs elsewhere in the tribe *Gossypieae* only in the genus *Hampea*.

Distribution (Fig. 7): Nigeria: vicinity of Kontagora (and Naraguta?); Ghana. It has a limited distribution, although described as "locally abundant" (Emsley, 1957). Plants of *C. heteroclada* are nearly acaulescent, flower directly from the perennial rootstock, and fruit in a relatively short time. The species is thus well-adapted to the periodically burned-over savannahs in which it occurs.

NIGERIA: Kontagora, Northern Nigeria, *Dalziel* 122 (G).

GHANA: Tongo Hills, E side of Zuarungu, *Morton* A 1286 (K); Tumu, nr Rest House, *Ahiokpor s.n.*, 10 June 1966 (GC) *Adams & Akpabla* 4364 (GC); roadside ca 2 mi S of Han, *Adams* 4013 (GC); footpath from Pwalgu Bridge to Gbeigo village, *Enti & Agyakwa s.n.*, 20 Jan 1966 (GC).

II SUBG. CIENFUEGOSIA

Cienfuegosia Cav., Diss. 3: 174, 1787 (as genus).

Leaves of variable form, generally punctate, but often obscurely so; foliar nectaries lacking. Flowers axillary, solitary, on unjointed peduncles (or peduncles sometimes articulated in *C. affinis*). Involucral nectaries 3 or none. Involucel of 8-12 bractlets (or involucel lacking in section *Friesia*); bractlets ungrouped, minute and subulate to prominent and lanceolate or spatulate. Calyx punctate (punctae sometimes obscure); lobes acute to acuminate. Petals punctate or epunctate, yellow (or nearly white in *C. tripartita*) with dark spot on claw often having yellow radii, or without spot. Stigmas decurrent or capitate, 3-5-lobed; styles

sometimes divided apically. Fruits glabrous or densely villous, punctate or epunctate, sometimes with hairs on inner suture line (in sect. *Cienfuegosia*).

Type species: The type of subg. *Cienfuegosia* is the type of the genus *Cienfuegosia*, *C. digitata* Cav.

KEY TO SECTIONS OF SUBGENUS CIENFUEGOSIA

- a. Stigmas decurrent (or at most subcapitate); fruits glabrous, epunctate; bractlets of involucl ca. 9, usually minute, linear-subulate; inner suture hairs present on capsule; involuclal nectaries usually present 4. *Cienfuegosia* (p. 205)
- aa. Stigmas capitate; fruits glabrous or pubescent, usually punctate; bractlets of involucl 8-10, lanceolate to spatulate, subequal to calyx, or lacking; suture hairs lacking; involuclal nectaries lacking:
 - b. Upright shrub or perennial herb; stipules filiform; involucl subequal to calyx; petals punctate 5. *Robusta* (p. 216)
 - bb. Perennial herb, decumbent or ascending; stipules subulate or auriculate; involucl subequal to calyx or lacking; petals epunctate (or at most obscurely punctate).
 - c. Involucl subequal to calyx; stipules subulate, symmetrical; plants procumbent or ascending 6. *Paraguayana* (p. 220)
 - cc. Involucl lacking; stipules auriculate, asymmetrical; plants procumbent 7. *Friesia* (p. 228)

4. SECT. CIENFUEGOSIA

Cienfuegosia Cav., Diss. 3: 174, 1787 (as genus).

Herbs or subshrubs arising from perennial woody rootstock. Stems ascending, green, 5-angled, minutely scurfy-puberulent to glabrous, obscurely punctate. Leaves entire, tripartite, or digitately divided, minutely puberulent to glabrous, punctate (but punctae obscure and usually visible only with magnification and careful illumination). Petioles canaliculate, minutely punctate, glabrous or minutely puberulent especially near juncture with lamina. Stipules minute. Peduncles glabrous to scurfy-puberulent, incrassate above, minutely punctate, surmounted by 3 involuclal nectaries (sometimes lacking). Involucl of ca. 9 elements; bractlets distinct, minute, filiform, persistent. Calyx 15-veined, prominently punctate, puberulent to glabrate; lobes acuminate or sometimes acute. Petals epunctate, yellow (sometimes white) with or without dark spot on claw. Stigmas decurrent (or subcapitate in *C. subternata*), 3-lobed; styles undivided. Fruits epunctate, 3-valved, glabrous without, with hairs on inner suture line.

Lewton (1925) drew attention to the capsular fringe of hairs that characterizes this section, as it is found in *C. heterophylla* (Vent.) Garcke and *C. yucatanensis* Millsp.

One of the most striking features of this section is the variability of leaf form within plants of all of the species. When speaking of leaf form in this group, therefore, it is necessary to use the concept of "leaf spectrum" (Melville, 1953). Type species: The type of sect. *Cienfuegosia* is the type of subg. *Cienfuegosia*, *C. digitata* Cav.

KEY TO SPECIES OF SECTION CIENFUEGOSIA

- a. Leaves deeply digitately divided, often secondarily so; anthers 5-ranked; petal spot (when present) and staminal column carmine; distribution African 8. *C. digitata*
- aa. Leaves entire, lobed, rarely with secondary divisions as above or trifoliate; anthers usually unranked; petal spot and staminal column dark-maroon (or spot

absent and staminal column light); distribution American.

- b. Leaves narrowly lanceolate to oblong, entire (lower leaves rarely trilobed); petiole glabrous; involucral nectaries usually lacking; corolla rotate; petals yellow, small (1-2 cm), lacking basal spot; pollen yellow; distribution Yucatan, Florida, Bahamas, Cuba 9. *C. yucatanensis*
- bb. Leaves broad and entire or variously divided; petiole puberulent at distal end; involucral nectaries present; corolla campanulate; petals yellow or white with basal spot; pollen orange or reddish; distribution Middle or South American.
- c. Leaves broadly ovate to moderately 3-lobed; distribution northern South America and Middle America.
- d. Style and stigma exceeding androecium; involucral bractlets 3-10 mm; leaves apiculate 10. *C. rosei*
- dd. Style and stigma largely included within androecium; involucral bractlets 1-3 mm; leaves usually acute to obtuse 11. *C. heterophylla*
- cc. Leaves large, entire to deeply divided or tripartite.
 - e. Leaves trifoliolate; leaflets narrow; petals yellow, with large basal spot having yellow radii; distribution Paraguay 12. *C. subternata*
 - ee. Leaves entire, cuneiform to variously divided (sometimes secondarily so); petals white or pale yellow, with small basal spot usually lacking radii; distribution Peru and Ecuador . . . 13. *C. tripartita*

8. *Cienfuegosia digitata* Cav., Diss. 3: 174, 1787 [Type: Senegal: Adanson 145A (Holotype: P, isotypes: MA, P)].

Fugosia digitata Pers., Syn. 2: 240, 1806.

Hibiscus Cavanillesii Kuntze, Rev. Gen. Pl. 1: 69, 1891 (based on *Cienfuegosia digitata* Cav.) non *H. cavanillesianus* H.B.K.

C. digitata var. *lineariloba* Hochr., Ann. Cons. Jard. Bot., Genève 6: 56, 1902 [Type: S.W. Africa: Grootfontein, Hereroland, 21 May 1899, Dinter 669 (Z)].

C. junciformis A. Chev., Rev. Bot. Appliq. 30: 267, 1950 [Type: Niger: Chevalier s.n. 16 Feb 1950 (PAT ? -n.v.)].

C. junciformis var. *ruyssenii* A. Chev., loc. cit. 268, (as *ruysseni*) [Type: Niger: Ruyssen s.n. (PAT ? -n.v.)].

Illustrations: Fig. 20, a-d; also Cavanilles (1787) Pl. 72, fig. 2, f-m; Lamarck (1819) iii, t. 577 (n.v.); Chevalier (loc. cit.) Pl. XII; Fryxell (1968) Fig. 3,h.

Plant minutely puberulent on meristems, becoming essentially glabrate throughout. Stems minutely and obscurely punctate. Leaves 5-ranked, digitately 3-5-parted; lobes often secondarily divided apically, sometimes simple, lanceolate to oblanceolate, acute. Petioles punctate, ca. $\frac{1}{2}$ length of lamina or less, minutely puberulent near juncture with lamina. Stipules 1-3 mm, linear, pubescent (sometimes glabrate). Peduncles axillary, solitary, unjointed, costulate, obscurely punctate, minutely puberulent to glabrate, 1-4 cm long ($\frac{1}{2}$ -1 $\frac{1}{2}$ times length of leaf), usually surmounted by 3 prominent involucral nectaries. Involucel bractlets 1-4 mm, usually glabrate. Calyx 1-1 $\frac{1}{2}$ cm long, minutely puberulent to glabrate, costulate (intercostal areas whitish), punctae $\frac{1}{4}$ mm diam., deeply lobed; lobes 3-ribbed, acuminate (sometimes acute). Petals yellow with carmine spot having yellow radii on claw (spot rarely lacking), 1 $\frac{1}{2}$ -2 $\frac{1}{2}$ cm (rarely larger), with undulate margin. Androecium carmine or pale; anther mass globose to obovate; anthers numerous, arranged in 5 ranks opposite the petals (or ranks divided to appear as 10); pollen orange. Style pallid, exceeding androecium; stigma decurrent, pubescent, whitish. Fruit ovoid, 8-12 mm, copiously hairy (hairs 2 mm) on internal suture margins. Seeds 3-4 mm, densely comose; hairs appressed, tan, 6-8 mm long. Embryo epunctate. Chromosome number: $n = 10$.

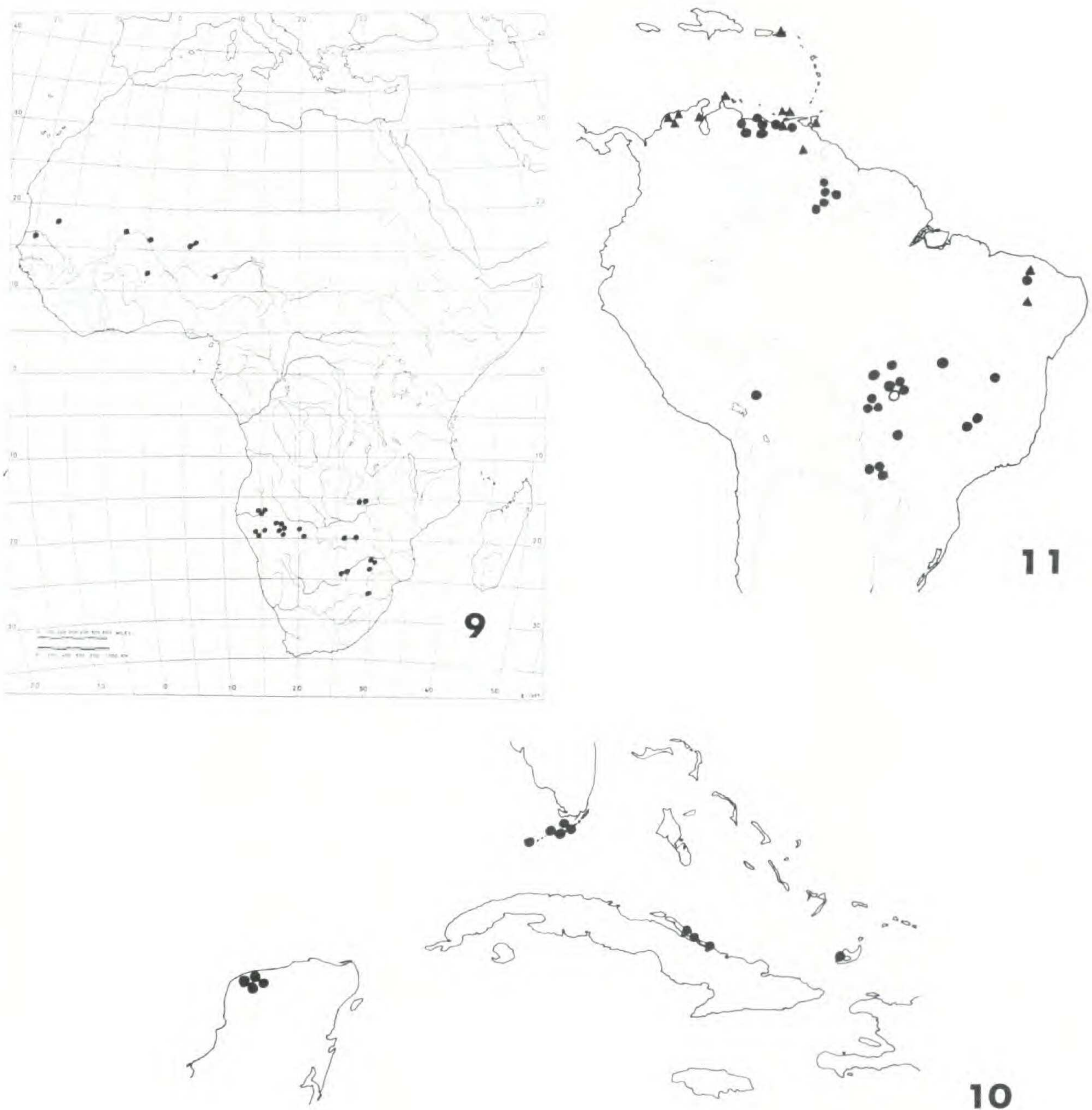


Fig. 9. Distribution of *C. digitata*. Fig. 10. Distribution of *C. yucatanensis*. Fig. 11. Distribution of *C. heterophylla* ▲, *C. affinis* ●, and *C. cuyabensis* ○.

Cienfuegosia digitata is relatively uniform morphologically, although leaf form exhibits considerable developmental plasticity. Herbarium specimens and cultivated plants both show this plasticity. Such phenotypic variation is well within the response potential of an individual plant, as indeed can be noted on the holotype of the species. Hochreutiner's var. *lineariloba* was based on such variation and has therefore been reduced to synonymy.

One aberrant specimen from the Transvaal (*Schlieben* 9248) produced multiple calyx lobes, a tendency not noted elsewhere. Most of the calyces on this specimen have 6 or 7 lobes rather than 5. This plant is, in all other respects, representative of *C. digitata*. The aberration therefore is considered not to have taxonomic significance. Another exceptional plant is *Davey* 224, which lacks a petal spot.

Distribution (Fig. 9): As previously noted (p. 186 and Fryxell, 1967b), this species has a disjunct distribution, occurring in western Africa and in southern Africa, but without any concomitant morphological differentiation. The northern segment of the distribution of *C. digitata* extends from Senegambia and southern Mauritania through Mali and northern Ghana to extreme western Niger and northern Nigeria. Reported occurrences as far east as the Sudan have not been substantiated and possibly refer to specimens of *Gossypium somalense* (Gürke) Hutch., as noted by Knight (1949). The southern segment of the distribution of *C. digitata* extends from the southern parts of Angola and Zambia and north-eastern S.W. Africa through Botswana to western Rhodesia and the Transvaal. Lignier & Bey (1905, p. 225) cite a specimen of *Fugosia digitata* from Madagascar in the Herbar Lenormand (CN), but the specimen has not been seen to verify its identity, and no other records from there are known.

MAURITANIA: Tagant Plateau betw Madjeria & Tidjikdje, silty flood plain, G. 62 (BM).

SENEGAMBIA: *Perrottet* 32 (G), 66 (BM, G, P, S,); Bords du Senegal (Walo) *Perrottet s.n.*, 1831 (G, L); Plaines de Richard, *Perrottet s.n.*, 21 Sep 1824 (G, LE); *Sieber* 58 (G, LE, M?, MO?, OXF?, S, UC); Daganá, *Leprieur* 1 (G, L, P); *Adanson* 145-A (MA, P); *Roger* 13 (LE); *Berhaut* 1344 (BR, Z); *Heudelot s.n.*, 1835 (LE), *s.n.*, 1839 (FI, OXF).

MALI: Ansongo, *Olufsen* 385a (C), *Hagerup* 385a (BR); Goumal (Dioura): *Davey* 224 (K), 233 (B); Env. de Tombouctou, *Legagneux s.n.*, Jun 1920 (L); Gourma : de Fada à Koupéla, *Chevalier* 24535 (BR).

NIGERIA: KANO: *Honold* 20 (Z).

ANGOLA: Huila betw Humbe and Ruacaná, Morros de Cualeque, Dongoena, c 1150 m, *Exell & Mendonça* 2872 (BM); Ruacaná, R Cunene, c 1000 m, *Exell & Mendonça* 2694 (BM), 2789 (MO).

SOUTH-WEST AFRICA: GROOTFONTEIN DISTR.: Tsumeb, *Dinter* 7459 (B, M), *Meyer* 21 (B); Farm Onguma, Gelbholzdüne, *Walter* 429 (M, PRE); Farm Fockshof, *Volk* 125 (M); Amboland, *Schinz* 212 (Z), 213 (Z), *Rautanen* 19 (LE, Z), *Dinter* 669 (Z). OUTJO DISTR.: Farm Franken, *Walter* 2/187 (M); Otuzemba, *Merxmüller & Geiss* 1355 (M, PRE); Farm Kaross, *Merxmüller & Geiss* 1549 (BM, M); Farm Hazeldene, Karos Block, *deWinter & Leistner* 5110 (M). SIMKUE DISTR.: *Story* 6509 (PRE); Klein Namutoni, *Breyer* 20592 (PRE); Onknanjumi, *Wulforth* 21 (Z); Ondonga, *Rautanen* 401 (Z); Vleyrand (Kalk) bei Naruchas, *Dinter* 7215 (B); Gautscha Pan, E of Karakuwise, *Maguire* 2183 (PRE).

ZAMBIA: Mazabuka, 3400 ft, *Bebbington* 1693 (K), 3300 ft, *Vet Officer* 249 (PRE).

BOTSWANA: Northern Bechuanaland betw Mumpswe and Sigara pans, ca 26 mi NNW of mouth of Nata River, Mopane Woodland, 900 m, *Drummond & Seagrief* 5215 (BM); Mochudi, *Harbor* 6481 (K); Crocodile River, *Klingberg s.n.*, Sep 1876 (S); nr Derdepoort, 3000 ft, *Codd* 8873 (PRE).

SOUTH AFRICA: TRANSVAAL: N of Soutpansberg, betw Vivo and Waterpoort rd to Mopane, *Schlieben* 9248 (G, M); Soutpansberg, Liliput, *Strey* 3493 (PRE), 5 mi S of Grass Valley, Potgietersrust, *Meeuse* 9581 (B, PRE); Klippan, Boshveld, *Rehmann* 5223 (Z); Bestersput im Distrikt Blomfontein, *Welte* 17 (Z), *Schlechter* 4664 (Z).

IN CULTIVATION: *Fryxell* 14008 (provenance: Outjo, SW Africa) (TAES).

9. *Cienfuegosia yucatanensis* Millsp., Publ. Field Mus. Nat. Hist. Bot. Ser. **2**: 74, 1900 [Type: Yucatan: arid stony soil about 6 km S of Progreso, 5 Mar 1899, *Millspaugh* 1693 (Holotype: F-61693)].

Illustrations: Fig. 20, e-g; also Small (1933) p. 860; Fryxell (1968) Fig. 3,i.

Plant glabrous throughout. Stems minutely and obscurely punctate. Leaves entire, oblong to lanceolate, acute, 4-10 (rarely 20) times as long as broad; lower leaves sometimes broader and trilobed. Petioles punctate, 1/2 length of lamina or less, glabrous. Stipules 1-2 mm, linear, glabrous. Peduncles axillary, solitary,

unjointed, costulate, obscurely punctate, glabrous, 2-5 cm long ($\frac{1}{2}$ - $1\frac{1}{2}$ times length of leaf); involucral nectaries usually lacking (rarely present, small). Involucel of 6-9 ungrouped bractlets; bractlets $\frac{1}{2}$ -2 mm, glabrous. Calyx glabrous, costulate (intercostal areas light green), punctae $\frac{1}{6}$ mm diam, 8-12 mm, equaling or exceeding fruit, deeply lobed; lobes 3-ribbed, acuminate. Petals yellow throughout, 1-2 cm, opening flat to form a rotate corolla. Androecium pallid, epunctate; anthers few (10-30), unranked; pollen yellow. Style pallid, sparingly punctate, exceeding androecium; stigma decurrent, pubescent, whitish. Fruit 3- (occasionally 4-) valved, 6-8 mm, ovoid, copiously hairy on internal suture margins. Seeds 2-3 mm, densely comose; hairs appressed, greenish-brown, 4-5 mm long. Embryo epunctate. Chromosome number: $n = 10$.

This species appears to be a specialized derivative of *C. heterophylla* (Vent.) Garcke. Its most notable specializations are in leaf form and in flower structure. The flower is small, opens to a fully rotate form, lacks the dark spot at the center characteristic of related species, and has significantly fewer anthers and produces smaller fruits and seeds. Whether or not these floral differences are related to a specific adaptation to local pollinators, is not known.

Small (1933) distinguished between the material from the "northern West Indies" and that (of *C. heterophylla*) from South America but did not associate the former with *C. yucatanensis* from Yucatan. He gave no nomenclatural recognition to the distinction.

Two accessions of *C. yucatanensis* are available in cultivation, one from Yucatan, the other from Great Inagua, Bahamas. The examination of these living plants shows that the two accessions are clearly conspecific, yet that they are demonstrably different in leaf spectrum and in certain other characteristics. The study of additional accessions of this species from different segments of its distribution may reveal distinctions requiring taxonomic recognition, but if so, at no higher rank than that of forma. For the present, no such distinctions are made.

Distribution (Fig. 10): Yucatan: in vicinity of Progreso and Merida; Florida: Grassy Key, Long Key, Lower Matecumbe Key, Lignum Vitae Key, and Key West; Cuba: Prov. Camaguey: Cayo Romano, Cayo Sabinal, and Cayo Guajaba; Bahamas: Great Inagua Island.

Such a distributional pattern, around the southeastern shores of the Gulf of Mexico, suggests salt-water dispersal of seed.

MEXICO: YUCATAN: Progreso, moist open places, Steere 3019 (F, MEXU, MICH); arid stony soil ca 6 km S of Progreso, Millspaugh 1693 (F); km 31 Merida Rd, Lundell & Lundell 8017 (F, GH, MEXU, MICH, TEX, US); Lukefahr s.n., 26 Jul 1964 (GH, LE, SD, TAES); Chichankanab, Gaumer 1269 (F); rd betw Sisal and Merida, Schott 693 (F).

UNITED STATES: FLORIDA: Lower Matecumbe Key, rocky hammocks, Small et al. 11599 (GH, MICH, MO, S, US), Small 8392 (C, M, S, UC), in dry sandy soil, Moldenke 619 (ILL, MO, S, US), Buswell 1387 (ARIZ); Lignum Vitae Key, Blodgett s.n. (GH), Chapman 747 (US), Garber s.n., Aug 1877 (GH, PH, US); Grassy Key, coral soil, Curtiss 398 (F, GH, LE, M, MO, PH, US); Long Key, Simpson 469 (F, GH, S, US); Key West, Chapman s.n. (US); S. Florida, Chapman s.n. (F, MO).

CUBA: CAMAGUEY: Cayo Guajaba, Shafer 634 (NY), 686 (F, GH, NY, US); Cayo Romano, Lomo de Loro, Shafer 2639 (F, GH, NY, US); Cayo Sabinal, in a kind of sweet water meadow, Ekman 15487 (F, G, GH, MO, NY, S, US).

BAHAMAS: Great Inagua, Dunbar 146 (GH).

IN CULTIVATION: *Fryxell 15013* (provenance: Yucatan) (ARIZ, TAES); *Fryxell s.n.* (provenance: Great Inagua, Bahamas) (C, CTES, GH, MICH, TAES).

10. *Cienfuegosia rosei* Fryxell, sp. nov. [Type: MEXICO: Oaxaca: between San Geronimo and La Venta, alt 200 ft, 13 July 1895, *Nelson 2779*, (Holotype: US, isotype: GH)].

Illustration: Fig. 20, o-p.

Frutex humilis, e radice perenni exoriens, puberula dense et minute in meristematis (pili stellati, ca. 0.2 mm), plus minusve glabrescens omnino. Caules virides, 5-angulati, ascendentes, punctati minute; internodia breviter. Folia ovata et integra vel trilobata moderate, 3-8 cm longa, apiculata, obscure punctata, circa latiora quam longa vel aliquantum angustiora. Petioli canaliculati, punctati, quam laminae $\frac{1}{4}$ - $\frac{1}{2}$ longiores, puberuli minute praesertim prope juncturas laminarum. Stipulae 3-7 mm longae, lineares, punctatae, puberulae. Pedunculi axillares, solitarii, inarticulati, incrassati supra, punctati minute, puberuli minute vel glabrati, 2-8½ cm longi, circa longitudines foliorum subtentiorum aequantes vel parum excedentes, 3 nectariis involucellis terminati. Involucella ca. 9 bracteolis inaggregatis formata; bracteolae involucelliarum distinctae, 3-12 mm longae, filiformes vel subspathulatae, interdum punctatae, puberulae vel glabratae, persistentes. Calyces puberuli vel glabrati, costati leniter, punctati (glandibus ad basem tubi calycis serialiter dispositis), 12-25 mm longi, profunde lobati; lobis calycibus 3-costatis, acutis vel acuminatis. Petala epunctata, 2½-3½ cm longa, flava pallida; unguis saepe macula marronina radios flavos habente. Androecia marronina; antheris numerosis (plus quam 30), imperfecte 5-fariam; pollenibus fusco-incarnatis; cumulis antherarum sphericis vel obovatis. Styli unici, punctati, androecia 6-8 mm excedentes. Stigmata decurrentia, marronina, trilobata, pubescentia, petala fere aequantia ad apicem lata. Fructus 3-loculati, epunctati, 10-13 mm, ovoidei, glabri extus, ciliati sparse in margine suturae. Semina 4-5 mm, dense comosa; pili crispipatentes, brunnei pallide, 5-6 mm longi. Chromosomatum numerus: $n = 10$.

Cienfuegosia rosei is in some respects morphologically similar to *C. heterophylla* but may be distinguished from the latter species by: its longer involucral bractlets (and stipules); its apiculate leaves; its larger flowers with the style notably exceeding the androecium rather than largely included within it; and the less prominently punctate calyx but more prominently punctate foliage. The plant appears also to achieve a smaller stature than *C. heterophylla*, with shorter internodes. As indicated in the discussion on phylogeny (p. 189), *C. rosei* is interpreted as having its closest affinity with *C. tripartita*. Its somewhat closer superficial resemblance to *C. heterophylla* is considered to be an example of convergent evolution. Biosystematic studies will permit verification or qualification of this hypothesis.

Rose recognized this plant as a new species in a manuscript name written on the isotype kept at the Gray Herbarium, but the name was never published. Rose's epithet, "humilis," is not taken up in publishing this species because of the possibility of confusion with the name published by Gürke, *C. phlomidifolia* var. *humilis*, even though Gürke's epithet is illegitimate and of different rank. The name *Cienfuegosia rosei* is chosen instead to honor J. N. Rose.

Distribution: Mexico: Oaxaca: in the lowland coastal plain around Tehuantepec. The plant is described by King (1356) as "abundant [in] flat grazed areas [among] cacti and thorny leguminous shrubs", as I can verify from observation of the same site.

MEXICO: OAXACA: betw San Geronimo and La Venta, *Nelson* 2779 (GH, US); 4 km NNE of Tehuantepec, *King* 1356 (MICH, TEX), *Fryxell* 749 (BH, CTES, F, MEXU, MO, NA, TAES, U); 12 km NNE of Tehuantepec, *King* 394 (MICH); cerca Juchitán, *Miranda* 8551 (MEXU); 7 mi W of Nilotepec, *Fryxell & Bates* 906 (BH, TAES).

11. *Cienfuegosia heterophylla* (Vent.) Garcke, Bonpl. 8: 150, 1860.

Redutea heterophylla Vent., Hort. Cels, t. 11, 1800 [Type: *Ventenat* s.n. (Holotype: G, isotypes: B (photo in GH, MO), FI, MO?, P)].

Fugosia heterophylla Spach, Hist. Veg. Phan. 3: 397, 1834.

Hibiscus Redoutei Kuntze, Rev. Gen. Pl. 1: 69, 1891 (based on *Redoutea heterophylla* Vent.).

Fugosia punctata Turcz. Bull. Soc. Nat. Mosc. 31: 196, 1858 [Type: Brazil: Serra de Jacobina, Bahia, *Blanchet* 2702 (Isotypes: BM, G, NY, OXF, P)] (non *Fugosia punctata* Cunn. ex Benth. 1863).

Illustrations: Fig. 20, h-k; also *Ventenat* (1800) t. 11; *Redouté* (1827) t. 118 (n.v.); *Spach* (1846) t. 4218; *Martius* (1892) Pl. 112, fig. 2; *Sampaio* (1926) Pl. 1, fig. 2 (illustr. of a single seed of doubtful identity, labelled "Flacourtiaceae-Cienfuegosia heterophylla."); *Fryxell* (1968) Fig. 3,g.

Plant minutely scurfy-puberulent (appearing lepidote) throughout, or glabrate on older foliage. Stems minutely and obscurely punctate. Leaves 5-ranked, entire, broadly ovate (sometimes rhomboid or obovate, rarely rotund) to moderately 3-lobed, acute to obtuse, rarely acuminate or apiculate, 2-3 times as long as broad (or broader, if lobed), ciliate-margined. Petioles punctate, $\frac{1}{4}$ - $\frac{1}{2}$ length of lamina, minutely puberulent especially near juncture with lamina. Stipules 2-5 mm, linear, pubescent. Peduncles axillary, solitary, unjointed, costulate, obscurely punctate, minutely puberulent to glabrate, 2-5 cm (rarely longer), approximately equaling or slightly exceeding (rarely greatly exceeding) length of leaf, surmounted by 3 involucreal nectaries. Involucre of 9 ungrouped bractlets; bractlets 1-3 mm, glabrate. Calyx minutely puberulent to glabrate, costulate (intercostal areas light green), punctae $\frac{1}{6}$ mm diam., 8-15 mm, deeply 5-lobed; lobes 3-ribbed, acute to acuminate. Petals 1-2½ cm, yellow with maroon spot having yellow radii on claw. Androecium maroon; anther mass globose; anthers numerous (> 30); pollen orange. Style pallid, barely exceeding androecium; stigma decurrent, reddish, pubescent. Fruit ovoid, 8-11 mm, copiously hairy (hairs 2 mm) on internal suture margins. Seeds 4 per locule, 3-4 mm, densely comose; hairs appressed, brown or tan, 6-8 mm long. Embryo epunctate. Chromosome number: $n = 10$.

The Geneva specimen from the Herbar de Ventenat is evidently the holotype since it matches Ventenat's plate (executed by Redouté) quite closely, whereas the Paris and Berlin plants do not match it.

Distribution (Fig. 11): Northern Colombia and Venezuela; certain of the Lesser Antilles (Aruba, Margarita, Trinidad, and St. Thomas); Brazil: provinces of Bahia, Piaui, and Ceara (?). Specimens from Oaxaca, Mexico that were ten-

tatively referred to *C. heterophylla* (Fryxell, 1967a), are here segregated as a distinct species, *C. rosei*.

This taxon occurs primarily around the borders of the Caribbean Sea, but it also occurs in northeastern Brazil in what may constitute a distributional disjunction. The Brazilian material is scanty, but differs from the typical form in being more densely puberulent throughout, and in having broadly acute (rather than acuminate) calyx lobes that are less prominently punctate (punctae ca. 1/10 mm diam.). These differences are too slight to merit recognition at any level higher than that of forma. Should the existence of such a taxon be confirmed by future studies, it would, of course, be best established on Turczaninow's description of *Fugosia punctata*.

COLOMBIA: MAGDALENA: in dry soil, La Paz, alt 200 m, *Haught* 4352 (US); Hwy, 7 km S of Riohacha, alt 20 m, *Haught* 4473 (F, NY, US); Santa Marta, alt 150 ft, *Smith* 779 (F, G, GH, L, MICH, MO, NY, P, PH, S, UC, US); *Wagner* 76 (FI, UC).

VENEZUELA: Maracaybo, *Plée* s.n. (P). SUCRE: Peninsula de Paria, *Steyermark & Agostini* 91287 (US); Cumaná, *Moritz* 529 (BM). BOLIVAR: along water in ditch betw Río Caroní and Ciudad Bolívar, alt 200 m, *Steyermark* 57634 (F, NY), *Moritz* 1038 (BM, NY, P, US); Orinoco, *Humboldt & Bonpland* s.n. (P).

ANTILLES: ARUBA ISLAND: *Boldingh* 6383 (L, NY, P). MARGARITA ISLAND: El Valle, *Miller & Johnston* 66 (F, GH, MO, NY, P, US); Porlamar, *Stephens* 1 (GH). TRINIDAD: Chacachacare Island, *Britton* 521 (GH, NY, US), *Richardson* 899 (IJ, US). ST. THOMAS: Krum Bay, *von Eggers* 350 (G, L, LE, M, Z), rocky hillside, Paradise Bay, *Britton & Britton* 211 (NY, US), *Hjalmarson* s.n., 24 Mar 1851 (S), *Rose* s.n., 1-5 Mar 1913 (NY, US), *Krebs* s.n., 23 Jan 1898 (C), *Raunkiaer* s.n., 28 Mar 1906 (C), *Blaumer* 9 (G).

BRAZIL: PIAUI: *Gardner* 2399 (FI, NY-but labelled "Prov. Ceara", OXF); BAHIA: Serra de Jacobina, *Blanchet* 2702 (BM, G, NY, OXF, P).

IN CULTIVATION: Hort Cels (from St. Thomas), *Ventenat* s.n. (B (photo in GH, MO), FI, G, MO?, P); (provenance: Isla Margarita, Venezuela) *Fryxell* 15004 (ARIZ, TAES); (provenance: Maracay, Venezuela) *Fryxell* 15010 (TAES).

12. *Cienfuegosia subternata* (Hassl.) Fryx., Taxon **16**: 321, 1967.

C. heterophylla (Vent.) Garcke subsp. *subternata* Hassl., Repert. Spec. Nov. **7**: 380, 1909 [Type: Peguahó, Sierra de Amambay, Paraguay, *Hassler* 10899 (Lectotype: G, specifically the sheet bearing Hassler's complete collection data; isotypes: G-2 additional sheets)].

Illustrations: Fig. 20, l-n.

Plant minutely puberulent on young foliage, becoming glabrate. Stems very obscurely punctate. Leaves trifoliolate, often unifoliolate above, rarely trilobed below; leaflets usually distinct, entire, lanceolate, acute, 7 cm long or less, ca. 1/10 as broad as long. Petioles 1/4 length of lamina or less (rarely longer on lower leaves), minutely puberulent especially near juncture with lamina. Stipules 2-3 mm, linear, puberulent. Peduncles axillary, solitary, unjointed, costulate, obscurely punctate, minutely puberulent to glabrate, 3-5 cm long (approximately equaling the leaf), surmounted by 3 involucrel nectaries. Involucrel of ca. 9 ungrouped bractlets; bractlets 1-3 mm, puberulent to glabrate. Calyx 1-1½ cm, glabrate, costulate (intercostal areas whitish), punctae < 1/4 mm diam, deeply lobed; lobes 3-ribbed, acuminate. Petals 2-3 cm, yellow with large (1 cm) maroon spot on claw having yellow radii. Androecium maroon; anther mass globose; anthers numerous (> 40); pollen yellow (?). Style pallid, punctate, glabrous, greatly exceeding androecium (nearly equaling petals); stigma sub-capitate (i.e.,

intermediate between decurrent and capitate forms), dark-red. Fruit ca. 1 cm, copiously hairy (hairs 2 mm) on internal suture margins. Seeds (immature) ca. 3 mm, angular, brownish-pubescent.

This species is a narrow endemic, clearly allied to the other species of this section, most obviously so in the nature of certain of its fruiting structures: involucler, calyx, and capsule. It is distinctive in its trifoliolate leaves and its large flowers with sub-capitate stigmas.

Distribution (Fig. 12): restricted to the valley of the Río Apa in northern Paraguay.

PARAGUAY: in campo humido argilloso, Peguahó, Sierra de Amambay, Hassler 10899, (G); Nördl. Paraguay (22-23° lat.) zwischen Río Apa und Río Aquidabán, Centurion, Niederer Camp, Sumpfrand an grasfreie Stelle, Fiebrig 4022, (G-4 sheets (photo of 1 in MO), GH, L, M; there are 2 additional sheets at Genève labelled "K. Fiebrig 5230" that may be duplicates of 4022).

13. *Cienfuegosia tripartita* (H.B.K.) Gürke in Mart., Fl. Bras. **12** (3): 578, 1892.

Redoutea tripartita H.B.K. Nov. Gen. Sp. Pl. **5**: 294, 1821 [Type: Peru: Jaen de Bracamoros: Humboldt & Bonpland s.n. (Holotype apparently lost; photographs are at MO and NY); Neotype: Peru: Dept. Cajamarca, Prov. Jaen, near the confluence of the Chinchipe and Marañon, 600-800 m, Weberbauer 6214, May 1912 (US, isoneotype: F, GH)].

Fugosia tripartita Steud. Nom. ed. II, **1**: 649, 1840.

Hibiscus tripartita Kuntze, Rev. Gen. Pl. **1**: 69, 1891.

Fugosia cuneata Benth., Bot. Voy. Sulph. **68**, 1844 [Type: Ecuador: Guayaquil: Sinclair s.n. (K-n.v., US-photo)].

Hibiscus cuneata Kuntze, Rev. Gen. Pl. **1**: 69, 1891.

Cienfuegosia heterophylla var. *cuneata* Macbr., Publ. Field Mus. Nat. Hist., Bot. Ser. **13**: 477, 1956.

Illustrations: Fig. 19.

Plant minutely scurfy-puberulent becoming glabrate. Stems punctate, sometimes obscurely so. Leaves of variable form: sometimes ovate-entire or ovate-crenate, more commonly 3- (rarely 5-) lobed in various degrees to completely trifoliolate, 2-7 cm long; leaflets lanceolate to obovate, entire or rarely secondarily divided, sometimes single and narrowly oblong. Petioles usually less than $\frac{1}{2}$ length of lamina, punctate, minutely puberulent near juncture with lamina (rarely puberulent throughout). Stipules linear, 1-3 mm, caducous. Peduncles axillary, solitary, unjointed, costulate, minutely punctate, glabrate, 2-9 cm long (approximately equaling or slightly exceeding length of subtending leaf), usually surmounted by 3 involucler nectaries. Involucler of 9 ungrouped bractlets; bractlets 1-3 mm, rarely longer, glabrous. Calyx glabrate, costulate, prominently punctate (punctae $\frac{1}{6}$ mm diam.), 1-1½ cm, deeply lobed; lobes 3-ribbed, acuminate. Petals epunctate (or rarely punctate), pale yellow to white with small maroon spot on claw (usually lacking radii), 3-4 cm (rarely smaller). Androecium maroon (sometimes light); anther mass elliptic; pollen orange. Style pallid, usually greatly exceeding androecium (nearly equaling petals), epunctate, (rarely punctate); stigma decurrent or rarely sub-capitate, pinkish; stigmatic lobes sometimes partially free. Fruit ovoid, 1-1½ cm, copiously hairy (hairs 2 mm) on internal

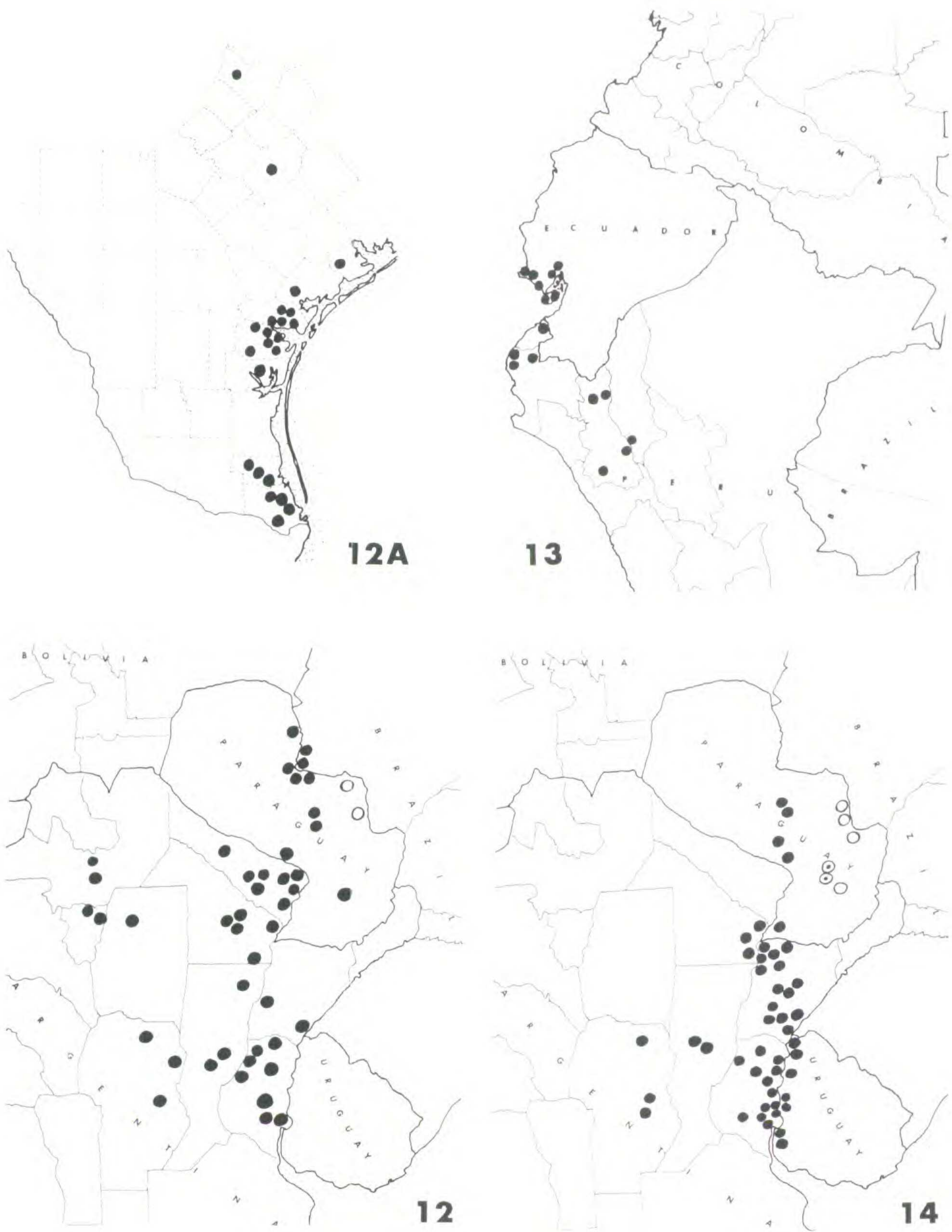


Fig. 12. Distribution of *C. subternata* ○ and *C. drummondii* ●, in South America. Fig. 12a. Distribution of *C. drummondii* in Texas. Fig. 13. Distribution of *C. tripartita*. Fig. 14. Distribution of *C. sulfurea* ●, *C. integrifolia* ○, and *C. subprostrata* ⊙.

suture margins. Seeds 5-9 per locule, 2-3 mm, comose; hairs appressed, tan, ca. 5 mm. Chromosome number: $n = 10$.

The holotype of *Redoutea tripartita* was in the Berlin herbarium and is now apparently lost. Photographs of this plant are in the NY and MO herbaria with the designation W.12836 from the Willdenow collection. The number 3601 also appears on this specimen, although it was not numbered by Humboldt and Bonpland. Apparently there were no isotypes, and no syntypes or paratypes were cited in the original description by Kunth. The situation, therefore, requires the selection of a neotype. One might under the Rules select as neotype either the photograph of the lost holotype or a suitably chosen specimen. Since the holotype was a poor specimen and according to Kunth was wormy, so that he had to rely on Bonpland's notes to some extent in preparing his description, it seems wiser to select a specimen as neotype. The specimen chosen is *Weberbauer 6214* (US-#1496233), which was collected near the type locality and which, in a rather variable species, conforms well to the holotype. Duplicates of this specimen are in F (628149) and GH.

Previous authors (Garcke, 1860; Hassler, Repert. Spec. Nov. 7: 380, 1909; Svenson, 1946; and Macbride, loc. cit.) noted an alliance between *C. tripartita* and *C. heterophylla*, but only Macbride recognized the alliance nomenclaturally. His choice of Bentham's epithet, *cuneata*, has priority in varietal rank.

The characteristically high degree of variability of leaf form found in sect. *Cienfuegosia* is especially well expressed in *C. tripartita*. The extremes of expression can often be found among the leaves of a single specimen of this species. The extent of this variability is aptly characterized in a collector's note, [*Haught 40* (US)], which says, "Leaves extremely variable in form — if found fossil, how many genera might be founded on those of a single specimen!"

The taxon is also quite variable in certain other respects, which may be best noted in *Hutchison & Wright 5422*, which shows the following atypical characteristics. In this specimen the herbage is more pubescent, the petioles shorter, the black glands more prominent and more widely distributed (even to the petals), and the stigma is of a subcapitate form. These are all deviations in the direction of *C. intermedia*. Further material may reveal a form that deserves taxonomic recognition.

Distribution (Fig. 13): Ecuador: from the Santa Elena peninsula and the vicinity of Guayaquil southward, including the Island of Puna; Peru: provinces of Tumbes and Piura, inland to Cajamarca and Amazonas. This taxon is apparently *not* contiguous with *C. heterophylla* in northern Colombia as has sometimes been implied.

ECUADOR: GUAYAS: Saños, *Asplund 5661* (US); Guayaquil, *Sinclair s.n.* (K-n.v., US-photo). ANCON DISTR.: Santa Elena Peninsula, *Sheppard s.n.* (K); Salinas, nr sea level, *Landeman 46* (K); Chanduy, in litore Maris Pacifici, *Spruce 6393* (BM); Puna, *Eggers 14767* (M), *Andersson 135* (S).

PERU: PIURA: Talara, *Haught 40* (NY, US); near the Amotapes where rain falls nearly every year, *Haught s.n.*, 1928 (F); Cerro Prieto, 20 mi E of Cape Pariñas, 1500 ft alt, *Haught 191* (US). TUMBES: cerca de Zarumilla, alt 30 m, *Ferreya 5962* (F, US). CAJAMARCA: Prov. Celendin, westl. Talwand des Marañon über Balsas, 2000 m alt, *Weberbauer 4262* (G); Prov. Jaen, nr confluence of Chinchipe and Marañon, 600-800 m,

Weberbauer 6214 (F, GH, US). AMAZONAS: Prov. Chachapoyas, Balsas on Río Marañon and upstream ca 4 km, alt 800 m, *Hutchison & Wright* 5422 (UC, US); *Vidal-Sénège s.n.*, 1876-77 (P).

IN CULTIVATION: (provenance: Playas, Ecuador) *Fryxell s.n.* (BM, TAES); (provenance: Chilete, Peru) *Fryxell s.n.* (TAES).

5. SECT. **Robusta** Fryxell, sect. nov.

Folia elliptica vel trilobata. Stipulae minutae, filiformes. Involucrum 8-10 phyllum; foliolia involucrorum calycem subaequantia. Nectaria involucrorum et foliorum nulla. Stigmata capitata, rubra. Petala punctata. Capsulae glabrae intus.

Plants upright or decumbent, shrubby or herbaceous, densely pubescent to glabrous. Leaves elliptic, acute (occasionally obtuse), or 3-lobed, punctate. Flowers axillary, solitary or rarely multiple, on unjointed peduncles (or peduncles sometimes articulate). Involucral nectaries lacking. Involucel of 8-10 bractlets; bractlets not grouped, prominent, subequal to calyx, distinct, linear-lanceolate to slightly spatulate. Calyx costulate, punctate (punctae sometimes obscured by pubescence), pubescent to glabrous; lobes acute to acuminate. Petals moderate to large, punctate (sometimes obscurely so), yellow with dark spot on claw having yellow radii. Stigmas capitate, red. Style greatly exceeding androecium, undivided. Fruits glabrous or densely villous without, glabrous within.

Type species: The type of sect. *Robusta* is *Cienfuegosia affinis* (H.B.K.) Hochr. The name of the section is chosen in reference to the larger, shrubbier growth habit found in the type species of this section.

KEY TO SPECIES OF SECTION ROBUSTA

- a. Leaves ovate to elliptic, entire, short petioled (ca 1/5-1/10 lamina length).
 - b. Plants densely pubescent except on upper surface of leaf (rarely glabrate); fruit ascending-villous; seed sub-glabrous to minutely puberulent. 14. *C. affinis*
 - bb. Plant glabrous; fruit glabrous; seeds hairy 15. *C. cuyabensis*
- aa. Leaves trilobed; petiole > 1/2 length of lamina 16. *C. intermedia*

14. *Cienfuegosia affinis* (H.B.K.) Hochr., Ann. Cons. & Jard. Bot., Genève **6**: 54, 1902.

Hibiscus affinis H.B.K., Nov. Gen. Sp. Pl. **5**: 289, 1821 [Type: inter Angostura et Trapiche de D. F. Farreras (Orinoco): *Humboldt & Bonpland* 1076 (P)]. (This location is near the present Ciudad Bolivar; see Sandwith 1925.)

H. sulphureus H.B.K., loc. cit. [Type: Quebrada de Cotecita, Caracas: *Humboldt & Bonpland* 593 (P)] non Wall ex Voigt, Hort. Suburb. Calc. 120, 1845.

Cienfuegosia sulphurea Hassl., Ostensia 343, 1933 (illegitimate, Article 64) non Garcke.

H. sulphureus var. *acutifolius* DC., Prodr. **1**: 451, 1824 [Type: ?].

Fugosia lanceolata Juss. in St.-Hil., Fl. Bras. Mer. **1**: 253, 1825 [Type: Brazil: *St.-Hilaire s.n.* (P)].

F. affinis Juss. in St.-Hil., loc. cit. [Type: Brazil: *St.-Hilaire s.n.* (Holotype: P, isotype: P)].

Hibiscus hilairei Kuntze, Rev. Gen. Pl. **1**: 69, 1891 (as *H. Hilairii*).

Fugosia phlomidifolia Juss. in St.-Hil., Fl. Bras. Mer. **1**: 253, 1825 [Type: Brazil, in campis prope vicum Chapada in parte provinciae Minas Geraës dicta Minas Novas: *St.-Hilaire s.n.* (Holotype: P, isotypes: F, P)].

Cienfuegosia phlomidifolia Garcke, Bonpl. **8**: 150, 1860.

Hibiscus phlomidifolia Kuntze, Rev. Gen. Pl. **1**: 69, 1891.

Fugosia campestris Benth. ex Hook., Jour. Bot. **4**: 120, 1842 [Type: British Guiana: dry savannahs, Rio Branco: *Schomburgk* 838, July 1840 (1839?) (Isotypes: BM, F, FI, G, GH, L-2 sheets, NY, OXF, P (photo-MO), US)].

Hibiscus campestris Kuntze, Rev. Gen. Pl. 1: 69, 1891.

Cienfuegosia affinis var. *campestris* Hochr., Ann. Cons. & Jard. Bot. Genève 6: 54, 1902.

Fugosia guianensis Klotzsch ex Schomb., Reise Brit. Guiana 3: 1171, 1848 [Type: Auf der Savanne an der Mündung des Pirara, Schomburgk s.n. (K-?)].

F. retusa Turcz., Bull. Soc. Nat. Mosc. 31: 197, 1858 [Type: Venezuela: prov. Cumanensis, prope Guanaguana, alt 2000 ped, Mar. 1846, Funck & Schlim 700 (Isotypes: G, LD, LE, W as photo MO)].

Cienfuegosia phlomidifolia var. *humilis* Gürke in Mart., Fl. Bras., 12(3): 575, 1892 [Type: Funck & Schlim 700] (illegitimate, Article 63).

Cienfuegosia affinis var. *humilis* Hochr., Ann. Cons. Jard. Bot., Genève 6: 54, 1902 (illegitimate, Article 63).

C. riedelii Gürke in Mart., Fl. Bras. 12(3): 576, 1892 [Type: in campis siccis prope Rio Pardo, Sept 1826, Riedel 543 (Type: LE)].

Hibiscus rectiflorus Rusby, Mem. N.Y. Bot. Gard. 7: 300, 1927 [Type: Bolivia: near Reyes, 24 Oct 1921, White 1538 (Holotype: NY, isotype US)].

Illustrations: Fig. 21, a-e; also St.-Hilaire (op. cit.) t. 50; Schumann (1890) fig. 20 L; Martius (1892) Pl. 112, fig. 1, Pl. 113, fig. 1; Szumkowski (1952) Fig. 1-6; (1953) Fig. 2-6; Fryxell (1968) Fig. 3,f.

Upright shrub, 1 to 6 or more feet high. Stems woody, densely pubescent (though pubescence sometimes absent on lush regrowth and often lost on old woody branches), terete, punctate. Leaves ovate to elliptic, entire, penninerved (veins prominent below), acute, sometimes obtuse, 3-12 cm long, about $\frac{1}{2}$ as broad (rarely narrower), rarely glabrate, generally weakly pubescent to glabrous above and densely to moderately pubescent below (young growth often yellowish-canescens), punctate. Petioles 1-15 mm (approximately $\frac{1}{10}$ length of lamina or less, the leaves sometimes subsessile), punctate, usually pubescent. Stipules filiform, pubescent, 3-10 mm, early-caducous. Peduncle axillary, solitary or sometimes multiple, unjointed or sometimes articulate, punctate, pubescent, 1-8 cm. Involucel of 8-10 bractlets; bractlets linear-lanceolate to sub-spatulate, pubescent, punctate (punctae often obscured by pubescence), 8-22 mm (nearly equaling calyx, persistent. Calyx 1-2 $\frac{1}{2}$ cm, punctae $\frac{1}{10}$ mm diam., often obscured by pubescence, densely to moderately pubescent; lobes 3-ribbed. Petals 2 $\frac{1}{2}$ -5 cm, yellow with maroon spot on claw having yellow radii. Androecium maroon throughout, punctate; anther mass obovate. Style pallid, punctate, greatly exceeding androecium (sometimes equaling petals); stigma 3-4-lobed, dark-red, pubescent. Fruit 3-4-valved, punctate, 1-1 $\frac{1}{2}$ cm, ovoid, densely ascending-villous without (hairs 1-2 mm). Seeds turbinate to sub-globose, 2-3 mm, sub-glabrous (covered with very short, sparse, rusty hairs). Embryo epunctate. Chromosome number: $n = 10$.

Vernacular names: In Venezuela *C. affinis* is known as "*algodon de sabana*" (cotton of the savanna). In Brazil the names "*algodão do campo*" (field cotton) and "*algodão bravo*" (wild cotton) have been recorded.

This species occupies a key position to our understanding of the subg. *Cienfuegosia*. It is herein interpreted as the most primitive species on the basis of its morphology. At the same time a remarkably clear transitional series connects this species directly with the more specialized representatives of sect. *Cienfuegosia*.

This plant is remarkably plastic in phenotype when grown in culture. Comparison of field-grown and greenhouse plants (the latter receiving partial shade and few temperature extremes) indicates that leaf shape, leaf size, petiole length,

amount of pubescence, and articulation of the peduncle are among the traits affected. Seasonal changes (temperature and/or photoperiod) have similar effects. Much of the considerable variation encountered in herbarium collections of this species is probably caused by ecologic (or seasonal) differences and does not represent genetic or taxonomic diversity, although ecotypic variation may exist as well. I therefore feel justified in presenting so rich a synonymy for a single variable taxon.

For example, the long-petioled glabrate phenotype that characterizes the holotype of *Fugosia lanceolata* (and also *Woronow* 7528) is similar to the phenotype of *Cienfuegosia affinis* growing in culture in its early flush of spring growth (cf. *Fryxell* 15016 and 15011). This same plant, during the balance of the growing season, develops the short petioles and dense pubescence that are typical of *C. affinis*. Thus, the type of *F. lanceolata* can confidently be assigned to *C. affinis* on the basis of its sericeous capsule and subglabrous seeds. The type of *C. riedelii* is an exceptionally tomentose specimen, but appears to differ in no other respect.

Perhaps more than one taxon exists within this group. If so, only the comparative culture of a wide range of material could demonstrate their existence.

The flowering response of *C. affinis* is under strong photoperiodic control when plants grow under conditions of fluctuating daylength (i.e., at higher latitude). *C. affinis* is distributed from approximately 10° N latitude to about 22° S latitude. Over the greater part of this area daylength does not vary significantly through the course of the year. Collation of collection dates of flowering specimens shows that this plant flowers in the field more or less throughout the year. When cultivated at higher latitudes, however, it flowers only under short-day conditions. At Tempe, Arizona (33° N latitude), for example, it flowers only from November through April and is completely vegetative during the summer months.

Distribution (Fig. 11): Venezuela and adjoining parts of Colombia; Brazil: Rio Branco (and in adjacent British Guiana), Ceara, Bahia, Minas Geraes, Goias, and Mato Grosso (and in adjacent parts of Paraguay and Bolivia). Szumkowski (1953) discussed the ecological and geographical distribution of *C. affinis* in the Venezuelan part of its range. His map (loc. cit., p. 6) does not indicate the complete distribution of the species in Venezuela, but only the locations where he made routine field observations on a seasonal basis. Szumkowski's field observations showed that the plant is widespread and abundant in the chaparral zone of Venezuela, and occurs primarily along the eastern slopes of the Cordillera de Merida (at altitudes up to 1100 m) and northeast to the coast in the vicinity of Caracas and Cumaná. It is also abundant in the plains that border the chaparral zone to the southeast (at an altitude of 100-200 m) in the states of Barinas and Portuguesa. The species apparently occurs under similar (chaparral and savanna) ecological conditions throughout its range.

COLOMBIA: *Moritz* 98 (G, LE); *Wagener* 350 (UC).

VENEZUELA: Cumaná, S. Antonio, *Funck* 181 (BM, G, LE, P); Cocollar, *Funck* & *Schlim* 700 [G, LD, LE, MO (as photo of W)]. MIRANDA: S slope of La Silla above Los Palos Grandes (Caracas), ca 1100 m, *Dennis* 2278 (K); thickets on roadsides, betw Turmero and Ocumare del Tuy, alt 1000 m, *Williams* 13585 (F). ARAGUA: prope Coloniam Tovar, *Fendler* 105 (BR, G, GH, K, NY, US), 106 (GH). DISTRITO FEDERAL: Caracas, *Elias* 183 (F), 223 (F), 398 (F), *Tatavinow* s.n. (LE), *van Landsberge* 249 (L); in savan-

nas, Lower Cotiza (Agr. Exp. St.), Pittier 8143 (MO, UC), Warming s.n., 11 Jan 1892 (C); Quebrada de Cotecita, Humboldt & Bonpland 593 (P), Curran & Haman 1072 (GH), de Grosourdy s.n., 1864 (P); thickets on side of rd to Baruta, alt 1000 m, Williams 13646 (F), Steyermark 55189 (F, NY); Trapiche de D. F. Farreras, Humboldt & Bonpland 1076 (P). CARABOBO: Llanos de S. Carlos, Linden 1456 (BM, BR, G, GH, LE, OXF), Warming 442 (C); Valencia, Warming s.n., 29 Dec 1891 (C), Eggers 13560 (C); Mariara, Mocquerys 960 (P); Llano de la Puerta, Woronow 7528 (LE).

BRAZIL: CEARA: Gardner 1459 (FI, G, GH, NY, OXF, P). RIO BRANCO: Boã Vista cume do serrote Murupuzinho, Ducke 2068 (IAN, R); Serra de Pracaieá, Surumú, Ule 7979 (K, L); terreno pedregoso, Serra do Quixada, Contão, Rio Cotingo, Silva 144 (MG, TAES). GOIAS: entre ———— et Conte Savaido Glaziov 20714 (BR, G, K, P), Weddell 2641 (P). MINAS GERAIS: Lagoa Santa, na Serra de Santa, da Costa 27A (R), Martius 2681 (M); in campis ad Contendar, Martius 2680 (M); in sepibus ad Columbi praed. Serro Frio, Martius 1397 (2678) (M); Riacho das Varas, Glaziov 18882 (C, P, R), Claussen 374 (BR), 549 (G), 950 (FI); Cons. Matta, Rodeador, Brade 13440 (B); Ituitabá, Macedo 372 (US), 4197 (US); Minas Novas, St.-Hilaire 1021 (F, MO (as photo), P), St.-Hilaire s.n. (Holotype of *Fugosia affinis* St.-Hilaire, P), St.-Hilaire s.n. (Holotype of *Fugosia lanceolata* St.-Hilaire, P). MATO GROSSO: Tapirapoan, Hoehne 1679 (R); Coxipó de Ponte, Cuyabá, Hoehne 4615 (R), 3000 (R); St. Luiz de Cáceres, Hoehne 198 (R), Landeman 2094 (K, OXF); Lava-pes Cáceres, Hoehne 171 (R); ad Rio Coxim, Riedel s.n. (OXF); in campis siccis, Rio Pardo, Riedel 543 (LE); Cuyabá, Malme s.n., 17 Jun 1902 (S); 40 km N de Cuiabá, Rio Mirini, Gregory et al. 9908 (LIL, TAES); Esmeril, Lindman A3037 (S); nr source of Rio Paraguay, betw Rio Amolar and Rio Nobres, 1500 ft, Smith 253 (K), Gaudichaud 44 (P), Raben 886 (BR); Itú, Riedel 2024 (GH, K, LE, P, US, Z); Oeiras, N Brazil, Jobert 1037 (P), Burchell 5620 (K), Pohl 223 (M).

BRITISH GUIANA: Roraima, Schomburgk 415 (BM, G, OXF); dry savannas on Rio Branco, Schomburgk 838 (BM, F, FI, G, GH, L, MO (as photo), NY, OXF, P, US); Limao (Mt. Roraima and vicinity), Tate 99 (NY); Rupununi Distr., Massara and Good Hope, Graham 248 (K).

PARAGUAY: Campo medio bajo Esperanza, in altaplanitie et declivibus "Sierra de Amambay," Hassler 10706 (C, G, K, MICH, MO, NY, P, S, UC, US); in campis in regione cursus superioris fluminis Apa, Hassler 8219 [B (photo in MO), C, G, GH, MICH, MO, NY, P, S, UC, US].

BOLIVIA: 200 m, Velasco 7 (NY), Jeuliet 727 (Juillet ?) (P); Reyes, White 1538 (NY).

IN CULTIVATION: (provenance: Maracay, Venezuela) Fryxell 15011 (ARIZ, TAES), 15016 (TAES).

15. *Cienfuegosia cuyabensis* Pilger, Engl. Bot. Jahrb. **30**: 171, 1902 [Type: Brazil, Mattogrosso: im Serrado bei Cuyabá, kriechend an trockenen, freien, sandigen Stellen, die Zweige dem Boden anliegend: Pilger 289, Mar 1899 (Holotype: B†, photo in MO); neotype: Brazil, Mato Grosso: Cuyabá, Malme 1666, 9 June 1902 (S)].

Illustrations: None.

Decumbent to ascending perennial subshrub. Stems slender, woody, glabrous, minutely but abundantly punctate, weakly ridged and greenish when young. Leaves narrowly elliptic, entire, acute, punctate, glabrous, penninerved (midrib prominent below), 3-6 cm long, 10-17 mm wide, 3-4 times as long as broad. Petioles 1-6 mm, glabrous. Stipules linear, ciliate, inconspicuous. Peduncles 1-3 cm long, glabrous, ridged. Involucel of 9-10 bractlets; bractlets linear (sometimes sub-spatulate), acute, glabrous, punctate, 1-nerved, 7-10 mm long, < 1 mm wide. Calyx 10-12 mm, glabrous; lobes acute, 3-ribbed; intercostal areas scarious. Petals 3-3½ cm, punctae translucent, yellow with maroon spot having yellow radii. Androecium maroon, anther mass obovate. Style elongate, nearly equaling petals,

undivided, pallid, punctate. Stigma dark-red. Fruit glabrous within and without, tuberculate, epunctate (?), ovoid, 8-10 mm. Seeds hairy; hairs tan.

The holotype of *Cienfuegosia cuyabensis* was apparently also among those lost from the Berlin herbarium, although a photograph of the holotype is preserved in the herbarium of the Missouri Botanic Garden. No isotypes of this species are known and no other specimens were cited by Pilger. Therefore, it is necessary to designate a neotype. *Malme 1666* is the only specimen available. Fortunately, it is an excellent one and conforms closely to Pilger's detailed description.

Distribution (Fig. 11): Brazil: Mato Grosso: apparently restricted to region around Cuyabá. Malme, however, notes it to be "not uncommon." His field notes state (translation from note attached to Stockholm specimen cited below): "In hills on somewhat open, somewhat moist localities, not uncommon but by this time [i.e., June] almost bloomed out. Of $\pm$ prostrate to commonly upright habit." Ulbrich (1914) states that this species also occurs in Bolivia, but I have found no evidence to support this assertion.

BRAZIL: MATO GROSSO: Cuyabá, *Malme 1666* (S); im Serrado, kriechend an trockenen, freien, sandigen Stellen, die Zweige dem Boden anliegend, *Pilger 289* (B†, photo in MO).

16. *Cienfuegosia intermedia* Fryx., Britt. **19**: 37, 1967 [Type: Mexico, with illegible label, and added number Herb. Lugd. Bat. No. 908, 140-849 (Holotype: L)].

Illustrations: none.

Low, herbaceous perennial arising from a woody rootstock. Stems weakly angled, punctate, glabrate. Leaves 3-lobed, 1½-2 cm long, about as broad; lobes oblong to obovate, sometimes constricted at base, obtuse to apically 3-dentate, glabrate above, ciliate-margined, punctate and sparsely scabrous below on veins. Petioles 10-12 mm, canaliculate, punctate, pubescent near juncture with lamina. Stipules 3-5 mm long, 1 mm broad, lanceolate, punctate, 1-nerved, ciliate, caducous. Peduncles 1½-3½ cm (exceeding leaves), axillary, solitary, not articulate, angled, punctate, sparingly pubescent (hairs stellate, 0.1-0.2 mm). Involucels of ca 10 bractlets, nearly equaling calyx; bractlets 8-10 mm long, < 1 mm broad, lanceolate, ciliate, punctate. Calyx deeply lobed, 10-12 mm, scabrous-ciliate on margins and veins, otherwise glabrate, lobes 3-ribbed, lanceolate, acuminate. Petals 2 cm, punctate, yellow with dark spot at base. Staminal column pallid; anther mass oblate. Style simple, punctate, nearly equaling petals; stigma red. Fruits unknown.

Distribution: In addition to the word "Mexico" and the number "2," the label on the holotype also bears the word "Mendes," which may refer either to the collector or to a locality.

MEXICO: (illegible label) (L-holotype).

6. SECT. **Paraguayana** Fryxell, sect. nov.

Folia simplicia vel exigua lobata, integra vel dentata. Stipulae subulatae. Involucrum 8-10 phyllum; folioli involucrorum calycem subaequantia. Nectaria involucrorum et foliorum nulla. Petala epunctata. Capsulae glabrae intus.

Plant decumbent to ascending, herbaceous to semi-woody, arising from perennial rootstocks, glaucous to pubescent, minutely punctate. Leaves entire to weakly lobed and dentate, rotund to elliptic or obovate. Stipules symmetrical, subulate. Flowers axillary, solitary, on unjointed peduncles. Involucral nectaries lacking. Involucel of 8-10 bractlets; bractlets prominent, distinct, not grouped, linear-lanceolate to spatulate. Calyx punctate, glabrate, pubescent, or scabrous; lobes acute to acuminate. Petals epunctate, yellow, with or without dark spot on claw; spot when present sometimes having yellow radii. Style single or slightly divided apically. Stigmas capitate. Fruits glabrous or densely villous without, glabrous within.

Type species: The type of sect. *Paraguayana* is *Cienfuegosia sulfurea* (Juss.) Garcke. The name of this section is chosen to emphasize the importance of Paraguay as a focal point of the distribution of *Cienfuegosia* as a whole, and of this section of the genus in particular. All four species of sect. *Paraguayana* occur in Paraguay; two of them are endemic to Paraguay.

KEY TO SPECIES OF SECTION PARAGUAYANA

- a. Leaves dentate, minutely puberulent to pubescent.
 - b. Foliage notably pubescent; leaves moderately dentate, as broad as long; seed hairs loosely appressed; calyx margin (and leaf margin) densely ciliate (hairs $\frac{1}{2}$ -1 mm); style divided apically; stigmatic lobes 3-4, distinct, light-colored; fruit 3-4-celled 17. *C. sulfurea*
 - bb. Foliage sparsely scurfy-puberulent becoming glabrate; leaves coarsely serrate, longer than broad; seed hairs tightly appressed (seeds appearing hairless); calyx margin not or scarcely ciliate; style undivided; stigma dark-red, 4-5-lobed; fruit 4-5-celled 18. *C. drummondii*
- aa. Leaves entire, glabrous.
 - c. Leaves glaucous, obovate, apiculate, primarily 3-nerved; stipules persistent, often equaling petioles; pedicels long (> 5 cm); calyx and involucel nearly glabrous; fruit glabrous; petioles $1/10$ - $1/4$ length of lamina 19. *C. integrifolia*
 - cc. Leaves orbicular to ovate, 5-nerved; stipules caducous, inconspicuous; pedicels short (1-4 cm); calyx and involucel scabrous; fruit ascending-sericeous; petioles about $\frac{1}{2}$ length of lamina 20. *C. subprostrata*

17. *Cienfuegosia sulfurea* (Juss.) Garcke, Bonpl. **8**: 150, 1860 (as *C. sulphurea*) non (H.B.K.) Hassl., Ostenia 343 (1933).

Fugosia sulfurea Juss. in St.-Hil., Fl. Bras. Mer. **1**: 252, 1825 [Type: Uruguay: paturage seca près le village de S. Salvador, province Cisplatina, St.-Hilaire 241 (Holotype: P, isotype: P)].

Hibiscus Jussieui Kuntze, Rev. Gen. Pl. **1**: 69, 1891 (based on *Fugosia sulfurea* Juss.).

Cienfuegosia sulphurea var. *genuina* Gürke in Mart., Fl. Bras. **12**(3): 577, 1892 (illegitimate, Article 26).

C. drummondii (A. Gray) Lewt. emend. Hassl., Ostenia 342, 1933 pro parte (illegitimate, Article 67).

C. drummondii var. *pubescens* Hassl., loc. cit. 343. [Types: prope Fray Bentos: *Arechavaleta* 1524 (MVM? -n.v.), and *Sellow* 1053 (?) syntypes].

Even though the combination *C. drummondii* (A. Gray) Lewt. emend. Hassl. is in contravention of Article 67, in that Hassler did not adopt the earlier epithet *sulfurea* from Jussieu [as Robinson (1895) had done earlier in combining these taxa], nevertheless the varietal epithet *pubescens* must be accepted as valid under the provisions of Article 68.

Illustrations: Fig. 22, e-h; also St.-Hilaire (op. cit.) Pl. 49; Rodrigo (1941) Fig. 2; Fryxell (1968) Fig. 3,k.

Procumbent perennial herb arising from woody root-stock, canescent on young growth. Stems terete to weakly ridged, densely hirsute (becoming glabrate in age), minutely punctate. Leaves orbicular to reniform, sometimes weakly 3-lobed, dentate to crenate, cordate to truncate, obtuse (or sometimes acute), 3-5-nerved, as broad as or broader than long, hirsute below, sparingly hirsute to glabrate above (hairs $\frac{1}{2}$ -1 mm), densely ciliate-margined. Petioles pubescent (especially near juncture with lamina), punctate, $\frac{1}{2}$ length of lamina or less. Stipules narrowly subulate, acute to acuminate, punctate, pubescent below, glabrous above, ciliate on margin, 1-4 mm. Peduncles pubescent, 1-5 cm, punctate. Involucel of ca 9 bractlets; bractlets hirsute (especially on margin), lanceolate to spatulate, acute, 5-10 mm long, 1-2 mm broad, 1-nerved, punctate. Calyx 10-15 mm, exceeding involucel, hirsute without, glabrous within, sometimes costulate; lobes broadly ovate, acute, 3-veined, densely ciliate (hairs $\frac{1}{2}$ -1 mm) on margins. Petals 1-2½ cm, yellow (sometimes turning blue-green in sicco), lacking basal petal spot or sometimes with vestigial spot. Androecium white (sometimes reddish in sicco), epunctate; anther mass obovate; stamens 5-ranked; anthers yellow. Style greenish-white, sometimes punctate, often slightly 3-4-parted apically; stigmatic lobes 3 to 4, usually free, light red. Fruit glabrous within and without, minutely punctate, 3-4-valved, 5-10 mm, globose. Seeds ca 4 mm, turbinate, comose; seed hairs tan to red-brown, appressed, 5-7 mm long. Embryo epunctate. Chromosome number: $n = 10$.

The original spelling of the specific epithet, *sulfurea*, was altered by Garcke to *sulphurea*, and his orthographic change has been perpetuated by most subsequent authors. The original spelling is here restored.

The flowers of this species sometimes develop cleistogamically, (cf. Fryxell, 1963).

Distribution (Fig. 14): Argentina: northwestern Córdoba, Santa Fé, Entre Ríos, Corrientes, and eastern Chaco; Uruguay: extreme western portion; Paraguay; in Río Paraguay valley. The trailing stems of this species form carpets over the ground in dry scrub and in moist meadows. It occurs both on heavy clay soils and on sand. In Entre Ríos and Chaco it is sympatric with *C. drummondii* and apparently occurs in mixed populations with it, as is attested to by several mixed collections (Lorentz 1428, Aguilar 1171, Krapovickas 7971, Schulz 169, and Molfino & Clos s.n.) that have been made. In spite of such confusion, however, the two species can be easily distinguished (see accompanying key, p. 221, and that given by Rodrigo, 1941), do not intergrade in nature, and hybridize in culture only with difficulty. The hybrids are lethal at an early age (Palacios & Tiranti, 1966). Another mixed collection from Corrientes (Schwarz 9949) indicates that *C. sulfurea* also occurs together with *C. ulmifolia*.

PARAGUAY: in arenosis pr. Concepción, Hassler 7315 (BM, G, K, MO, NY, P, S, UC); San Salvador, Rojas 2592 (M, G); Prov. Pilar, Curuparitz, Schulz 7978, (LIL).

ARGENTINA: CHACO: Dpto. Resistencia: Colonia Benítez, Schulz 169 (BAB-p.p.), 627 (S); Margarita Belén, Aguilar 640 (LIL), 1037 (LIL), 1171 (LIL-p.p.), Meyer 2653 (LIL); Campo de Tajamar, Schroeter 37 (BAB). CORRIENTES: Dpto. Curuzú Cuatiá: Spegazzini s.n. (149?), 2-4 Apr 1940 (BAB), park-like country on heavy clay, Ruta 14, ca Km 625, Pedersen 4698 (BR, C, US), Perugorria, Cabrera 10572 (LIL, M), Ibarrola 2556 (LIL), 2263 (BAB, LIL); al norte de Sauce, Castellanos 34437 (BA). Dpto.

Mburucuyá: Estancia "Santa Maria," *Pedersen* 5283 (C, P, S.). Dpto. San Cosme: Paso de la Patria, Costa Toledo, 55 m, *Meyer* 8792 (LIL). Dpto. Capital: Santa Catalina, *Ibarrola* 944 (LIL), *Malvarez* 1473 (LIL), *Hicken* s.n., 26 Mar 1902 (SI), *d'Orbigny* 86 (P), *Ibarrola* 2668 (LIL), *Dupre* s.n. (P), *Com. Escuela del Centenario* 78 (BA). Dpto. Mercedes: *Spegazzini* s.n. (69?), 23-31 Mar 1940 (BAB), Justino Solari cercanías, *Ibarrola* 2607 (SI), Camino de la Feria, *Rodrigo* 606 (NY). Dpto. Empedrado: *Schwarz* 9949 (LIL-p.p.), El Sombrero, *Schwarz* 10084 (LIL). Dpto. Monte Caseros: Mocrete cercanías, *Ibarrola* 2423 (LIL). Dpto. San Martín: en bosque de Quebracho Blanco, Nandubay 5 km N de Pellegrini, *Krapovickas* 7956 (LIL), entre Mercedes y Pellegrini, en monte de Nandubay y espinillos, *Krapovickas* 7961 (LIL); Bella Vista, *Rojas Acosta* s.n., Oct 1904 (BAB). SANTA FE: Dpto. San Cristóbal: Estacion Hersilia, *Muniez* s.n., 25 Jan 1907 (BAB), *Balegno* 612 (LIL). ENTRE RIOS: Dpto. Concordia: Federal, *Molfino & Clos* s.n., 31 Mar 1927 (BAB-p.p.) *L. H.* s.n., 15 Feb 1917 (BA), Federación, *Crovetto & Piccinini* 4701 (BAB), *Crovetto & Leguizamón* 4913 (BAB, TAES). Dpto. La Paz: *Lorentz* 1428 (UC-p.p.), Sauce de Luna, *Krapovickas* 7971 (LIL, SI-p.p.); Colón, *Meyer* 10595 (LIL), *Castellanos* 1168 (BA); Gualaguaychú, *Jurado* 15 bis (SI), *Garcia* s.n., 17 Jan 1943 (LIL); Pehuajo Norte, *Serié & Mijoya* 665 (BA); Concepción del Uruguay, *Lorentz* 883 (BM, FI, G, GH, L, LE, M, OXF, P, UC, Z), 571 (UC), 253 (UC), s.n., April 1880 (P), s.n., 3 May 1880 (CORD), *Schulz* 305 (LIL), *Baez* 75 (BA); Picada, *Naboulet* 164 (BA); Villaguay, *Meyer* 11273 (LIL), *Müsch* 995 (GH). CORDOBA: Río Tercero, Estancia, *Stuckert* 9679 (CORD, G, S), 10042 (G, S); Río Primero, Estancia "San Teodoro," *Stuckert* 11558 (CORD, G), 21440 (CORD, G, TAES); San Justo, Sacanta, *Stuckert* 7081 (G), 9940 (G, S).

URUGUAY: Entre Belén y Bella Unión, *Ragonere & Piccinini* 6554 (BAB, TAES); Paturage seca près le village de S. Salvador, Provincia Cisplantina, *St.-Hilaire* 241 (P); Manatíal cerca de Mercedes, *Castellanos* s.n., 23 Jan 1947 (LIL); cerca de Bella Unión, *Castellanos* s.n., 28 Mar 1948 (LIL); Nera (Soriano), *Berro* 1466 (G); Salto, *Osten* 5407 (US); Fray Bentos, *Fruchard* s.n., 29 Jan 1879 (1899?) (P).

IN CULTIVATION: (provenance: Colonia Benitez, Chaco, Argentina) *Fryxell* 15007 (ARIZ, TAES).

18. *Cienfuegosia drummondii* (A. Gray) Lewt., Bull. Torr. Bot. Club **37**: 473, 1910.

Fugosia drummondii A. Gray, Pl. Wright. 1: 23, 1852 [Type: Gonzales, Texas: *Drummond* 42, 1834 (Holotype: K, isotypes: BM, GH, LE, OXF, P)].

Hibiscus drummondii Kuntze, Rev. Gen. Pl. 1: 69, 1891 non Turcz. Bull. Soc. Nat. Mosc. **31**: 195, 1858.

Cienfuegosia sulphurea Garcke emend. Robins. in Gray & Robins., Syn. Fl. N.A. 1(1): 337, 1895 pro parte.

C. sulphurea var. *drummondii* Hochr., Ann. Cons. Jard. Bot., Genève **4**: 173, 1900.

Elidurandia texana Buckl., Proc. Acad. Sci. Philad. **1861**: 450, 1862 [Type: Texas: on the banks of the Colorado River above Austin, *Buckley* s.n., May-June 1861 (PH)].

Hibiscus pulverulentus Griseb., Abh. Königlich. Ges. Wiss. Gött. **24**: 49, 1879 [Type: Argentina: Salta: *Lorentz & Hieronymus* 1082, Nov 1873 (Holotype: GOET, isotype: UC)].

Fugosia pulverulenta Hochr., Ann. Cons. Jard. Bot. Genève **4**: 173, 1900.

Cienfuegosia sulphurea var. *glabra* Gürke in Mart., Fl. Bras. **12**(3): 577, 1892 [Type: *Lorentz & Hieronymus* 1082].

C. sulphurea var. *glabra* f. *intermedia* Chod. & Hassl., Bull. Herb. Boiss., ser. 2, **5**: 302, 1905 [Type: Paraguay: in arenosis prope Concepción, Sep 1901, *Hassler* 7315b (G)].

C. sulphurea var. *major* Hassl., Repert. Spec. Nov. **7**: 379, 1909 [Types: Paraguay: Gran Chaco, ad ripam occidentalum flum. Paraguay, latit. S. 22° 21' - 23° 30', Oct 1903, *Hassler* 2416 (Lectotype: G- Herb. Delessert, isotypes: G, GH, NY, P, S, UC); *Rojas* 100 (Syntype: G)].

C. drummondii var. *genuina* Hassl., Ostenia 343, 1933 (illegitimate, Article 26).

Fugosia sulphurea var. *trifida* Griseb. ex Rodrigo, Darwiniana **5**: 220, 1941 nomen nudum.

Although the type of *Hibiscus pulverulentus* Griseb. was cited by Gürke in publishing *Cienfuegosia sulphurea* var. *glabra* Gürke, the latter epithet cannot be rejected under Article 63 as nomenclaturally superfluous, but must be retained as

legitimate since it is of different rank. The two names are, of course, synonymous, since they are based on the same material.

Illustrations: Fig. 22, a-d; also Smith (1895) Pl. 49; Seckt (1929-1930) Pl. 13, Fig. 370; Rodrigo (1941) Fig. 3, C & D; Fryxell (1963) Fig. 1, a & b, (1968) Fig. 3,j.

Perennial herb or subshrub, arising from woody rootstock. Stems semi-decumbent to ascending, angled, sparsely puberulent to glabrate, minutely punctate. Leaves coriaceous, ovate to elliptic, sometimes weakly 3-lobed, coarsely serrate to denticulate (rarely subentire), glabrate (margin not or scarcely ciliate), minutely punctate, about $1\frac{1}{2}$ times as long as broad, truncate, acute. Petioles $\frac{1}{2}$ length of lamina or less, minutely puberulent near juncture with lamina or glabrate throughout, triquetrous, punctate. Stipules subulate or lanceolate, 1-8 mm long, $\frac{1}{2}$ -1 mm broad, punctate, caducous, glabrate to ciliate-margined, acute to acuminate. Peduncles sparingly puberulent to glabrate, 2-11 cm, punctate. Involucel of 8-10 bractlets; bractlets lanceolate to spatulate, 6-14 mm long, 1-nerved, acute to acuminate, punctate, minutely puberulent or glabrate (rarely setose), 1-2 mm broad. Calyx 10-20 mm, exceeding involucel, inconspicuously punctate, minutely puberulent or glabrate (rarely setose), sometimes weakly costulate; lobes lanceolate, acute to acuminate, 3-nerved, rarely sparingly ciliate-margined, sometimes laciniately divided into 2 or 3 teeth. Petals $1\frac{1}{2}$ - $3\frac{1}{2}$ cm, yellow (sometimes turning blue-green in sicco), with solid dark-red basal petal spot, or with petal spot lacking. Androecium epunctate, whitish (or dark-red if petal spot is present); anther mass obovate; stamens 5-ranked; pollen yellow. Style greenish-white, punctate; stigma 4-5-lobed, dark-red. Fruit glabrous within and without, minutely (and sometimes obscurely) punctate, 4-5-valved, obovoid-obtuse (sometimes ovoid-rostrate), 8-14 mm. Seeds angularly turbinate, tan, 3-4 mm; seed hairs tightly appressed (seeds appearing hairless). Embryo epunctate. Chromosome number: $n = 10$.

Hochreutiner (loc. cit.) noted that Grisebach's *Hibiscus pulverulentus* belongs in *Fugosia* (i.e., *Cienfuegosia*) but did not consider the problem beyond making the new combination. Kearney (1953) independently made the same observation, noting the existence of the UC isotype, but he identified the plant as *C. sulphurea* (St.-Hil.) Garcke on the basis of the keys of Rodrigo (1941) and Hutchinson (1947). I have examined this specimen, as well as the holotype (GOET), and it unquestionably belongs in *C. drummondii*, not in *C. sulphurea*. These two species are not distinguished by Hutchinson, but are clearly distinguished by Rodrigo.

Three vernacular names and three medicinal uses for this species are on record. Seckt (1929-30) records the name "*mercurio*" for what is apparently (on the basis of his illustration) this species, although he identifies it as *C. sulphurea* (St.-Hil.) Garcke. On *Escobar 13* (BAB) from the province of Chaco the same name is recorded, together with the information that "la medicina lugareña la utiliza como purgante." On a specimen from Colonia Benitez, Chaco, without indication of collector or date (BAB), the name "*yerba del indio*" is recorded together with the statement "para llagas gargarismo." On *Rojas 13589* and *Pier-*

rotti 1 the name “guaicurú caá” is given together with the indication that the plant is used as an astringent. This name is evidently in the guaraní language (Cadogan, 1957) and may best be translated as “plant of the Guaicurú Indians,” a name comparable to the spanish “yerba del indio.” In none of these cases is the part of the plant used for these medicinal purposes given.

This species is polymorphic for petal spot and pigmentation of the androecial column, these two traits simply being two expressions of the same condition. This variation is assumed to have a simple genetic basis and little or no taxonomic significance. Mixed populations apparently occur, judging from mixed collections that I have seen, e.g., *Lindman* A2235 (S).

Distinctive features of this species include the tendency to develop divided calyx lobes, which are notable in *Venturi* 551 (SI) for example, and the 4-5-lobed stigma and 4-5-valved capsule, that are in contrast to the basically trimerous condition found generally in the remainder of the genus.

Distribution (Fig. 12 and 12a): Argentina: Salta, Tucumán, Santiago del Estero, eastern Chaco and Formosa, Corrientes, Santa Fé, Entre Rios, and Córdoba; central Paraguay; Brazil: southernmost Mato Grosso in the vicinity of the Rio Apa; United States: Texas, in a narrow belt from Brownsville north to Austin, being fairly abundant in the vicinity of Corpus Christi. There appears to be no basis for Small’s (1933) suggestion that this species may occur on Key West, Florida.

In Argentina *C. drummondii* grows to some extent in mixed populations with *C. sulfurea* and also with *C. ulmifolia*. It is found in low, moist areas with heavy soils that are often saline; its salt-tolerance appears to be high.

Subsequent to the original description of *Fugosia drummondii* and *Elidurandia texana* by Gray and Buckley, respectively, the history of the Texas occurrence of this plant has received considerable attention (Coulter, 1891; Heller, 1895; Smith, 1895; Lewton, 1910; Hanson, 1921; Hutchinson, 1947), and its notably disjunct distribution has been discussed by Bray (1900), Hutchinson (1947), and Fryxell (1967b). The essential facts may be summarized as follows:

Collector	Locality	Date	Collector	Locality	Date
Drummond	Gonzales	1834	Hanson	Gregory	1919
Buckley	near Austin	ca. 1861	Schulz	Brownsville	1924
Heller	Corpus Christi	1894	Eifrig	Bishop	1925
Nealley	Corpus Christi	1894	Tharp	Woodsboro	1925
Lewton	Taft	1910	Lewton	S. of Dallas	1925

More recent collections [including several seed collections (Lukefahr and Martin, 1962) made available to the author by Dr. M. J. Lukefahr] indicate that the plant occurs commonly, not rarely as reported earlier, in the areas of Brownsville and Corpus Christi. The extension of its range to the north of Corpus Christi (including both type locations) is more problematical, however, since it has not been collected in this area for over 100 years, if one ignores the unsatisfactory designation of locality on Lewton’s 1925 collection.

The distributional disjunction shown by *C. drummondii* was probably achieved relatively recently by dispersal from the southern hemisphere to the northern

(Fryxell, 1967b). The time or means of this dispersal are not immediately evident. However, circumstantial evidence suggests that bird dispersal in recent times is a probable explanation. Cruden (1966) and Proctor (1968) discuss the plausibility of birds as plant dispersal agents and note that members of the *Charadriiformes* are likely agents of long-distance dispersal. Proctor emphasizes the capacity of these birds to retain seeds in their crops for long periods, especially seeds in the size range shown by *C. drummondii*, and subsequently to disgorge them intact and thus to disperse them in migration over great distances. Cruden emphasizes the dispersal potential of seeds adhering in mud to the feet and feathers of migrating birds. This explanation is also plausible for *C. drummondii*, since it occurs in moist habitats, although such a means of dispersal lacks force as a general explanation of disjunction since many of the disjunct plant species occur in dry, upland habitats, which the birds do not frequent and where the conditions are not favorable for the adherence of the seeds to the birds. In any case, the latitudinal similarity of the two portions of the distribution of *C. drummondii* supports the idea that migrating birds are the responsible dispersal agents.

UNITED STATES: TEXAS: Gonzales, *Drummond* 42 (BM, GH, K, LE, OXF, P); banks of the Colorado above Austin, *Buckley s.n.* (Holotype of *Elidurandia texana* Buckl.: PH); S of Dallas, *Lewton s.n.*, 25 Aug 1925 (S). Calhoun County: Port Alto, *Drushell* 114 (P). Refugio County: *Drushell* 176 (P); Woodsboro, Bayside, *Tharp* 3606 (TEX, US). San Patricio County: weed in cotton fields, Gregory, *Hanson s.n.*, 7 Jun 1919 (GH, MO); Welder Wildlife Refuge near Sinton, *Tharp s.n.*, 9 Oct 1958 (TEX); roadside, 4 mi NE of Sinton, *Fryxell* 701 (TAES); Bishop, *Eifrig* 21 (F); slightly saline soil on open bottom, near Sinton, *Wolcott & Barkley* 16T416 (F, TEX); 8 mi SW of Taft in swale, *Jones* 413 (SMU). Nueces County: 1 mi N of Robstown, *Chapman* 3014 (TEX); nr Gardendale, S of Corpus Christi, *Johnston* 53175.14 (TEX). Kleberg County: Agua Camp, *Johnston* 541181 (SMU, TEX). Corpus Christi: *Heller* 1808 (GH, PH, S, UC), *Nealley s.n.*, 1894 (F, LIL, MO). Cameron County: "Victoria" soils area, *Johnston s.n.*, June 1952 (TEX); Brownsville, *Schulz* 2969 (F); Laguna Atascosa Wildlife Refuge, *Fryxell* 436 (CTES, TAES), *Van Fleet* 6095 (TEX); Olmito Rd, near Arroyo Colorado, *Clover* 1259 (MICH). Willacy County: among mesquite and cactus, *Shiller* M5 (TAES); Sauz Ranch, *Johnston* 53175.15 (TEX).

BRAZIL: MATO GROSSO: Porto Murtinho, *Malme s.n.*, 2 Jan 1903 (S), *Robert* 887 (BM); Porto Pachico, *Moore* 1056 (BM).

PARAGUAY: Chaco, Puerto Casado, *Rojas* 1935 (G, M, SI), *Gregory et al.* 10601 (LIL), *Lindman* A.2235 (S); Puerto Guaraní, campo palmar, *Rojas* 13589 (G, LIL, MO, TEX); ad ripam occidentalem flum, Paraguay, *Hassler* 2416 (G, GH, K, MO, NY, P, S, UC), *Pride s.n.* (K), *Fiebrig* 1233 (G, K, M, S, Z); en face de l'Assomption, *Balansas* 1875 (P). CONCEPCION: *Hassler* 7315b (G), 7317 (BM, G); Pilcomayo River, *Morong* 929 (BM, GH, MO, NY, PH, US), *Rojas* 100 (G); in regione locus Yparacay, Cordillera de Altos, *Hassler* 12390 (C, G, GH, K, L, MO, NY, US, Z); ad ripam rivi Igneri, *Hassler* 1477 (BM, K, G); von nassem Weisen, Fuerto Olympo, *Ansits* 2163 (S); poor saline soil, foot of Cordillera de Villarica, *Jorgensen* 3814 (BA, F, GH, LIL, NY, PH, S, SI); Puerte Yatayba, *Daguerie* 967 (BA), *Kuntze s.n.*, Nov 1892 (NY).

ARGENTINA: FORMOSA: Dpto. Pilcomayo: Ruta 11 Cda. a Laguna Blanca al km 7, *Morel* 2192 (LIL, UC), al km 2, *Morel* 2141 (GH, LIL); Ruta 86 al S. O. a 36 km de Puente Gobernacia, *Morel* 2756 (LIL, MO); al E de Puerto Porteña a 2 km, *Morel* 2388 (LIL); Ruta 11 Clorinda a Formosa km 4, *Morel* 1684 (LIL); camino de Clorinda a Paraiso, *Rojas* 8975 (SI). Dpto. Pirané: Pilagá, *Morel* 734 (LIL, US), 33 (GH, LIL), *Pierotti* 4226 (LIL), 4268 (LIL); Casco Cué, *Morel* 896 (LIL, NY); Guayacan (20 km al noroeste de Pirané), *Pierotti* 6 (LIL, SI); Estero Grande, *Reales* 63 (LIL); Estancia Lacoré, *Pierotti* 1 (LIL); Laguna de los Rios, *Reales* 73 (LIL); Monteagudo, *Reales* 172 (LIL). Dpto. Clorinda: Curema, *Reales* 312 (LIL). Dpto. Patino: Las Lomitas FCE, *Krapovickas* 1293 (LIL), 1305 (LIL). Dpto. Formosa: 10 km de la ciudad, sobre ruta 11 al N, *Krapovickas* 992 (LIL), *Jorgensen* 3054 (BA, MO), *Kermes* 282 (BAB, TAES). CHACO: Dpto.

Resistencia: Colonia Benitez, *Schulz* 169 (BAB-p.p.); Margarita Belén, *Aguilar* 1263 (LIL), 1171 (LIL-p.p.). Dpto. Florencia: La Sabana, *Basaldua* s.n., Oct 1904 (BAB). Dpto. Nopalpi: Las Cuchillas (Lote F), *Buratovich* 338 (LIL); La Clotilde de P. R. Sáenz Peña, *Buratovich* 284 (LIL), *Baez* 12 (BAB); Rio Bermejo, Rosario del Dorado, *Flossdorf* s.n., 27 Aug 1906 (BAB); Sección 17, *Flossdorf* s.n., 28 Nov 1906 (BAB, TAES); Fontana, en suelos arcillo-arenosos, *Meyer* 2074 (GH, LIL); en campos humedos, *Meyer* 684 (LIL). ENRIQUE URIEN: *Meyer* 4685 (LIL), *Schulz* 3780 (LIL); Las Palmas, *Jorgensen* 2316 (BA, GH, LIL, SI, US); Samuhi, *Escobar* 13 (BAB, TAES); Chaco Central, *Asp* 89 (SI); Laguna Blanca, *Aguilar* 63 (LIL). CORRIENTES: Dpto. Monte Caseros: Libertad, costa arroya Curuzá, *Ibarrola* 2511 (LIL); Goya, *Boelke* 1519 (SI). ENTRE RIOS: Dpto. Feliciano: arroyo Puerto, *Castellanos* 1170 (BA); Feliciano, *Crovetto & Cherini* 6109 (BAB). Dpto. Concordia: Federal, *Molfino & Clos* s.n., 31 Mar 1927 (BAB-p.p.), *L. H.* s.n., 15 Feb 1917 (BA). Dpto. La Paz: Alcazar, *Krapovickas* 7972 (LIL), *Saphis* 239 (SI); Sauce de Luna, *Krapovickas* 7971 (SI-p.p.); Algorrobenwald bei La Paz, *Lorentz* 1428 (UC-p.p.); Gualeguaychú, *Jurado* 15 (SI), s.n., May 1920 (BA); Villaguay, Est. Santa Martha, *Müsch* 36 (SI); Colonie Hernandarias, *Lorentz* 1372 (UC); Colonia "Avigdor" Bovril FCE, *Krapovickas* 261 (LIL). SANTA FE: Dpto. San Cristóbal: Arrufó, *Balegno* 729 (LIL), "La Gua-suncha" entre E. Rams y Hercitia, *Krapovickas* 743 (LIL). Dpto. Gral. Obligado: Villa Ana, *Hayward* 01464 (LIL), 01465 (LIL). Dpto. San Justo: La Criolla, *Castellanos* 19560 (BA); 14 km S de Vera y Pintado, *Krapovickas & Cristóbal* 14325 (CTES, TAES). Dpto. Vera: Caraquatay, borde de camino, isleta de sosque, *Krapovickas* 7818 (LIL). Chaco Santa-fecino: Mocoví, *Venturi* 190 (SI), *Lynch* s.n., Nov 1903 (BA); Indio Muerto, *Comezaria* 2727 (LIL); Videla, *Ragonese* 2089 (BA-p.p.); Malabrigo FCSF, en el terraplén del FC, *Krapovickas* 348 (LIL). CORDOBA: Dpto. Unión: Escuela de Bell-Ville, s.n., 24 Apr 1907 (BAB). Dpto. San Justo: Balneario, *Balegno* 1097 (LIL); Jeanmarie, en las inmediaciones de la Estación, *Hunziker* 11367 (CORD, TAES); San Francisco, *Borsini* 1254 (LIL). SANTIAGO DEL ESTERO: Dpto. Pellegrini: orilla del salitral, 500 m, *Venturi* 5678 (GH, LIL, SI, US). TUCUMAN: Dpto. Leales: Chañar Poso, hab. terrenos salitrosos, 300 m, *Venturi* 551 (BA, G, LIL, SI, US); *Diaz* 63 (BAB). SALTA: *Lorentz & Hieronymus* 1082 (GOET, UC). Dpto. Capital: Tiro Federal, *Correa* 29 (LIL).

IN CULTIVATION: (provenance: Argentina) *Fryxell* 15012 (TAES); (provenance: Texas) *Fryxell* 15006 (ARIZ, TAES).

19. *Cienfuegosia integrifolia* (Chod. & Hassl.) Fryxell, comb et stat. nov.

C. sulphurea var. *integrifolia* Chod. & Hassl., Bull. Herb. Boiss. 2 ser., 5: 302, 1905 [Type: in campis pr. Igatimi, Paraguay, 4 Nov 1898, *Hassler* 5444 (Holotype: G-Herb. Boissier, isotypes: BM, G, NY, P)].

C. subprostrata var. *vera* Hassl., Repert. Spec. Nov. 7: 379, 1909 (illegitimate, Article 63).

The same specimen is cited as type of both names cited above. Therefore, the name *C. subprostrata* var. *vera* Hassl. is nomenclaturally superfluous and must be rejected under Article 63.

Illustrations: none.

Low ascending herb arising from perennial rootstock. Stems glabrous, obscurely punctate, weakly angled. Leaves glaucous, minutely punctate, entire, 3(-5)-nerved, orbicular to obovate, truncate to cuneate, obtuse to apiculate. Petiole glabrate, canaliculate, obscurely punctate, 1-5 mm, rarely longer. Stipules narrowly linear, acuminate, often equaling or exceeding the petioles, 1-nerved, punctate, glabrate, persistent. Peduncles 3-10 cm (rarely to 18 cm) (exceeding leaves), glabrous, minutely punctate, incrassate above. Involucel of ca. 9 bractlets; bractlets often unequal, punctate, glabrous, 1-nerved, linear-lanceolate to weakly spatulate, 1/2 to 1 1/2 cm long, 1-2 mm broad (adjacent bractlets sometimes connate forming broader element). Calyx, 12-18 mm, equaling or exceeding involu-crum, obscurely punctate, glabrous to sparingly scabrous (on veins); lobes broadly

ovate, 5-8 mm broad, acute to acuminate, 3-5-nerved. Petals 3½ to 5 cm long, yellow with dark maroon spot having yellow radii. Androecium dark maroon throughout; anther mass obovate; anthers 5-ranked (?). Style greatly exceeding androecium (nearly equaling petals), punctate, reddish (?); stigma 3-lobed, dark red. Fruit (from immature example) ovoid, epunctate, rostrate, glabrous. Seeds unknown.

Distribution (Fig. 14): Paraguay: along the northeastern border in the Sierra de Maracayú and the Sierra de Amambai and southward as far as Caaguazú (at ca. 26° S. Lat.).

This species is known ecologically only from the few brief comments made by collectors: "in campis siccis," "campo colina," and "in campis combustis." The last comment suggests a similarity in its adaptation to that of *C. heteroclada* of Nigeria, a similarity that extends in part at least to its vegetative morphology.

PARAGUAY: In campis in regione vicine Igatimi, Sierra de Maracayú, *Hassler 5444* (BM, G, NY, P); prope Caaguazú, in campis siccis, *Hassler 9376* (G, K, NY, UC); Sierra de Amambay, in campis combustis Estrella, *Hassler 10221* (G); campo colina, *Rojas 6207* (G).

20. *Cienfuegosia subprostrata* Hochr., Ann. Cons. & Jard. Bot. Genève **6**: 57, 1902. [Type: In regione vicine San Estanislao, Sierra de Maracayú, Jan 1899, *Hassler 6011* (Holotype: G, isotypes: B (photo in MO), BM, GH, K, MO, NY, P, S, UC)].

Illustrations: Fig. 21, f-g.

Stems weak (trailing?), glabrous, ridged, obscurely punctate. Leaves entire, orbicular to ovate-elliptic, obtuse to acute, 5-nerved, obscurely punctate, reticulate, glabrous. Petioles canaliculate, punctate, ¼ length of lamina or longer (6-12 mm), glabrous or slightly hirsute near juncture with lamina. Stipules inconspicuous (1-2 mm), filiform, glabrate, caducous. Peduncle 2-4½ cm, costulate, obscurely punctate, glabrate to sparingly scabrous above. Involucel of 9-10 bractlets; bractlets lanceolate to spatulate, acute, 1-3-nerved, punctate, sparingly scabrous on margin and midrib (hairs 1 mm), 7-14 mm long, 1-3 mm broad. Calyx 12-17 mm (exceeding involucel), obscurely punctate, costulate, scabrous on veins and margin (hairs 1 mm); lobes 3-nerved, acute, ovate-lanceolate. Petals 3-4 cm, yellow with large maroon spot (with yellow radii). Androecium maroon throughout; anther mass obovate; anthers 5-ranked. Style greatly exceeding androecium (nearly equaling petals), punctate, whitish; stigma red, 3-lobed. Fruit 3-celled, ovoid, rostrate, 10-12 mm, ascending-sericeous. Seeds 4 mm, turbinate, comose; seeds hairs appressed, tan.

Distribution (Fig. 14): known only from central Paraguay in the vicinity of San Estanislao.

PARAGUAY: SAN PEDRO: In arenosis, in regione vicinis San Estanislao, Sierra de Maracayú, *Hassler 6011* (B, BM, G, GH, K, MO, NY, P, S, UC); Río Tapiracuay, 8 km de San Estanislao, camino a Rosario, campo cerca del río, *Krapovickas et al. 13945* (CTES, TAES).

7. SECT. **Friesia** Fryxell, sect. nov.

Herbae prostratae. Folia simplicia vel profunde dissecta. Stipulae auriculatae. Involucrum nullum. Petala epunctata. Capsulae glabrae intus.

Plants prostrate, herbaceous, arising from perennial woody rootstocks, glabrate to hirsute, punctate (but punctae very obscure). Leaves simple to lobed, parted or dissected, serrate or crenate. Stipules asymmetrical, auriculate-clasping (rarely falcate), acuminate. Flowers axillary, solitary, on unjointed peduncles; peduncles ascending in flower, recurved in fruit. Involucral nectaries lacking. Involucel lacking (although vestigial bractlets have been noted on individual specimens of two species). Calyx costulate, lobes acuminate or rarely acute. Petals epunctate, yellow, with or without dark spot on claw; spot when present sometimes having yellow radii. Style single or slightly divided apically. Stigmas capitate. Fruits 3-valved, glabrous within and without. Seeds appressed-hairy.

Type species: The type of sect. *Friesia* is *Cienfuegosia argentina* Gürke. The section is named in honor of R. E. Fries who, in describing *C. hispida* R. E. Fries, noted the alliance of this group of species.

KEY TO SPECIES OF SECTION FRIESIA

- a. Leaves weakly lobed or variously parted; leaf margins crenate; tips of calyx lobes often hirsute.
 - b. Leaves nearly simple to moderately parted (sometimes deeply and secondarily so), glabrate; style divided apically, stigmas light-colored 21. *C. argentina*
 - bb. Leaves weakly tri-lobed, hispid below and on petioles; style undivided; stigmas dark-red 22. *C. hispida*
- aa. Leaves simple or deeply dissected; leaf margins serrate; tips of calyx lobes glabrous.
 - c. Leaves simple; stipules prominent (3-11 mm long, 2-6 mm broad); petioles $\frac{1}{2}$ length of lamina or less 23. *C. ulmifolia*
 - cc. Leaves deeply dissected (or if simple, much reduced); stipules small (2-7 mm long, 1-3 mm broad); petioles $\frac{2}{3}$ length of lamina or more 24. *C. hasslerana*

21. *Cienfuegosia argentina* Gürke in Mart., Fl. Bras. **12**(3): 579, 1892 [Type: Argentina: Salta: La Florida, Rio de Tala, Feb. 1873, *Lorentz & Hieronymus* 384 (Lectotype: UC; isoelectotypes: MO (photo), BR, G, NY, US)].

Hibiscus argentinus Kuntze, Rev. Gen. Pl. **3**(2): 19, 1898 non Speg. (1901).

Fugosia argentina Hochr., Ann. Cons. & Jard. Bot. Genève **4**: 172, 1900.

Gürke cites *Lorentz & Hieronymus s.n.* and *Lorentz & Hieronymus* 1006, in addition to the lectotype. These specimens therefore become paratypes.

Illustrations: Fig. 23, a-e; also Martius (1892) Pl. 113, fig. 2; Rodrigo (1948), Fig. 3 (labeled *C. argentina* var. *Hasslerana* f. *escholtzioides*); Fryxell (1963) Fig. 1, c & d (labeled *C. argentina* var. *hasslerana*); (1968) Fig. 3, l.

Stems procumbent, weakly ridged, very obscurely punctate (appearing epunctate), sometimes pubescent but more commonly glabrate. Leaves ovate, simple to variably divided, sometimes deeply digitately 3-5-divided, crenate, glabrate (sometimes minutely ciliate-margined, rarely hirsute), truncate, obtuse to acute, 5-nerved, punctate (but punctae detectable only on youngest leaves); lobes rounded, sometimes secondarily divided apically. Petioles canaliculate, $\frac{1}{4}$ - $\frac{1}{2}$ (rarely to $\frac{3}{4}$) length of lamina, more or less pubescent near juncture with lamina, otherwise glabrate (rarely pubescent throughout), minutely punctate. Stipules sessile, auriculate (sometimes falcate), ciliate-margined (hairs $\frac{3}{4}$ mm), glabrous ventrally, pubescent to glabrate dorsally, 2-6 mm long, $\frac{1}{3}$ mm broad, punctate, 1- (sometimes 3-)

nerved, persistent. Peduncles 1-6 cm, minutely puberulent (especially above) to glabrate, minutely punctate, slightly costulate. Involucel lacking. Calyx 15-ribbed, 10-18 mm, equaling or exceeding fruit, minutely pubescent throughout or glabrate (but usually pubescent apically), scarious intercostally, minutely and sparingly punctate (but punctae obscure and located close to veins: therefore often appearing epunctate); lobes 3-ribbed, ciliate-margined, generally pubescent at apex (hairs 1-1½ mm, ascending). Flowers sometimes cleistogamic. Petals with undulate margin, 2-3 cm, yellow with small dark-red spot on claw. Anther mass globose; filaments from pale to dark red; anthers yellow-orange. Style apically 3-parted, greenish, punctate, exceeding androecium; stigmatic lobes white to somewhat reddish in sicco, pubescent. Fruit epunctate (?), 3-loculed, 6-12 mm, ovoid. Seeds 3-4 mm, turbinate, comose; seed hairs appressed, brown, 3-5 mm. Embryo epunctate. Chromosome number: $n = 10$.

Distribution (Fig. 15): Argentina: abundant in the provinces of Tucumán and Salta, occurring in adjacent parts of Santiago del Estero and Catamarca, and extending as far southward as Córdoba. It extends northward into Bolivia and northeastward to central Paraguay.

Cienfuegosia argentina is a trailing herb that occurs primarily in open fields, apparently preferring sandy soils. Its principal distribution occurs at altitudes of 700-1500 m, but it probably also occurs at lower altitudes in Paraguay and at least as high as 1700 m in Bolivia.

BOLIVIA: Gran Chaco, Tatarenda, in campo aprico procumbens, *Fries 1446* (S); Quirusillas-Vallegrande, 1700 m, *Troll 929* (B, M).

PARAGUAY: Chaco Paraguayo, Isla Poi, *Rojas 7019a* (G); Carandayty, *Rojas 7179* (G).



Fig. 15. Distribution of *C. argentina* ● and *C. ulmifolia* ○. Fig. 16. Distribution of *C. hispida* ○ and *C. hasslerana* ●.

ARGENTINA: SALTA: Dpto. Anta: 1ª Sección, El Dorado, *Luna* 1037 (LIL); 3ª Sección, *Luna* s.n., 13 Feb 1948 (LIL); 10 km NE of Lumbreras, alt 710 m, *West* 8396 (GH, MO, UC). Dpto. Candelaria: Ruiz de los Llanos, *O'Donell* 4715 (LIL), *Schreiter* 9439 (BA, LIL); en los campos, 1000 m, R. *S[chreiter]* s.n., 26 Mar 1929 (LIL), *Venturi* 8761 (GH, US); Quebrada Sta. Barbara, 1000 m, *Schreiter* 5808 (F, LIL), *O'Donell* 4718 (LIL); entre Ruiz de los Llanos y R. de la Frontera, *O'Donell* 5460 (LIL). Dpto. Metán: camino de Horcones a El Porvenir, *Carenzo* 322 (LIL); Lumbreira, *Ruiz* 494 (LIL); Metán a Salta, *O'Donell* 5482 (LIL); entre Metán y R. de los Llanos, *Legname & Cuezco* 3035 (LIL). Rosario de la Frontera: *Schreiter* 1549 (B, BAB, F, LIL, TAES, US), *Lillo* 4402 (F, G-3 sheets, one of which is labelled "Trancas, Prov. Tucuman," LIL, NY), *de la Sota* 86 (LIL). Río de Tala: La Florida, *Lorentz & Hieronymus* 384 (B, BR, G, MO - as photo, NY - labelled "prov. Catamarca" rather than "prov. Salta," UC, US); cerca de La Cañada, 2540 (LIL), *Meyer* 21185 (LIL); Cormel Moldes, a orilla del Río Chanapampa, *Hunziker* 1159 (LIL, NY); camino de Salta a Tucumán, *Villalón* s.n. (LIL); Joaquim V. Gonzales, *Aguilar* 269 (LIL); Güemes, *Meyer* 8368 (LIL). TUCUMAN: Dpto. Trancas: Río Tala, *Venturi* 7370 (US), *Rodriguez* 12 (G, LIL, US); zwischen Alduralde und Trancas, *Lorentz & Hieronymus* 1006 (UC); a San Pedro de Colalao, *Schreiter* 7414 (LIL); Burrucayu, *Stuckert* 12821 (G), 9128 (G), 16969 (G, LIL, S), *Wall* 37 (S), *Diaz* 3 (BAB, TAES). CORDOBA: Los Mogotes, Sierra Chica de Córdoba, *Holmberg* s.n., 6 Feb 1877 (BA). CATAMARCA: Dpto. Ancasti: Las Tunas, *Spegazzini* s.n., 14 Feb 1910 (BAB), s.n., 20 Feb 1910 (BAB). SANTIAGO DEL ESTERO: Dpto. Robles: Furena, *Maldonado* 241 (NY, S), *Argañarás* 144 (SI); Garza, *Krapovickas* 10043 (LIL); entre Beltán y El Simbolar, *Krapovickas* 10042 (LIL); El Simbolar, *Krapovickas* 10041 (LIL).

IN CULTIVATION: (provenance: Colonia Benitez, Chaco, Argentina) *Fryxell* 15003 (ARIZ, LE, TAES).

22. *Cienfuegosia hispida* R. E. Fries, Kungl. Sv. Vet. Handl. **24**: 33, 1947
[Type: Argentina: Salta: orilla de un salitral, Cerro Negro, Antillas, 700 m, 19 Mar 1930, *Venturi* 10311 (Holotype: S, isotypes: GH, MO, NY, US)].

Illustrations: Fig. 23, f-h; also Fries (op. cit.) Pl. 7, fig. 2; Rodrigo (1948) Fig. 1, A-E.

Stems procumbent, hirsute (hairs 1 mm) becoming glabrate, apparently epunctate. Leaves ovate to weakly 3-lobed, dentate, truncate, obtuse to acute, sparingly hirsute becoming glabrate above, hispid below (primarily on veins), ciliate-margined, nearly as broad as long, 3-5-nerved. Petioles densely hispid throughout, canaliculate, punctate, $\frac{1}{4}$ - $\frac{1}{3}$ (rarely $\frac{1}{2}$) length of lamina. Stipules subulate to auriculate, sessile, hirsute (on vein) to glabrate, ciliate-margined, 3-4 mm long, 1-3 mm broad (sometimes larger), persistent. Peduncles 2-2½ cm (sometimes longer), sparsely hispid, obscurely punctate. Involucel lacking (one vestigial bractlet is discernible on the holotype). Calyx 15-ribbed, 12-20 mm, densely hispid in bud, moderately so in flower and fruit (especially on veins and margin), apparently epunctate; lobes lanceolate, acuminate, 3-ribbed. Petals 2-3 cm, yellow with large dark-red spot. Androecium dark red; anthers orange (?). Style exceeding androecium, whitish; stigma red, pubescent. Fruit 8-10 mm, glabrous (?). Seeds comose; seed hairs tan.

Although *C. hispida* is closely allied to the other species of sect. *Friesia* and is known only from a relatively few specimens, it appears to be a distinct taxon, distinguished by its vestiture, its large seeds (according to Rodrigo, 1948), its large petal spot, and its leaf form.

Distribution (Fig. 16): Argentina: provinces of Salta, Tucumán, and Santiago del Estero. In addition Rodrigo (1948) cites and illustrates a specimen (*Berti &*

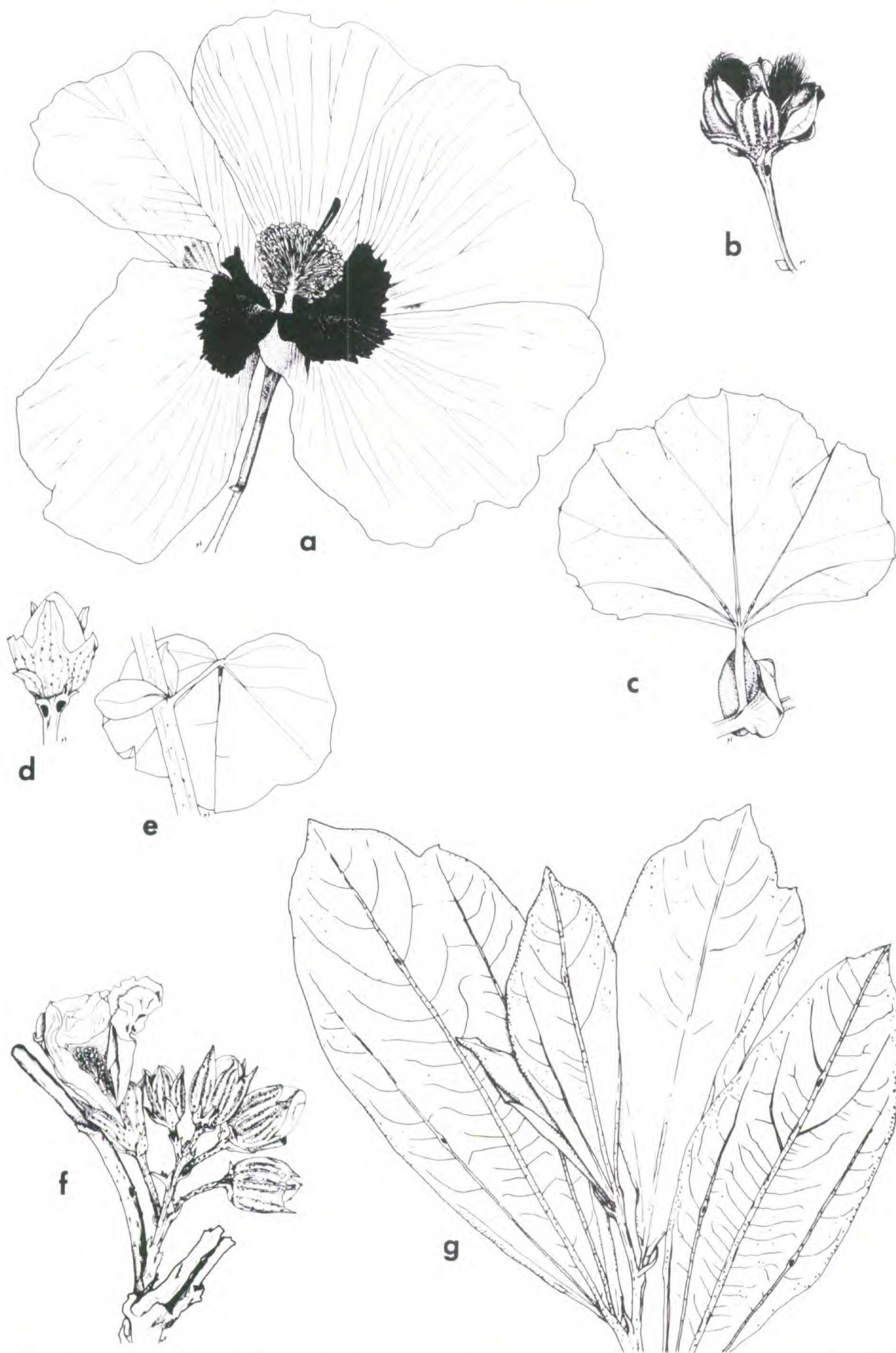


Fig. 17. A-C, *Cienfuegosia hildebrandtii* Garcke: A, flower [Fryxell 14007 (TAES)]; B, mature fruit [Fryxell 14001 (TAES)]; C, leaf [Fryxell 14007 (TAES)]. D-E, *Cienfuegosia gerrardii* (Harv. ex Harv. & Sond.) Hochr.: D, bud [Liebenberg 3492 (PRE)]; E, leaf [Wood 11722 (PRE)]. F-G, *Cienfuegosia heteroclada* Sprague: F, tip of vegetative shoot [Ahiekpor s.n. (GC)]; G, flowering shoot, arising from base of preceding year's stem [Enti & Agyakwa s.n. (GC)]. All $\times 1$.

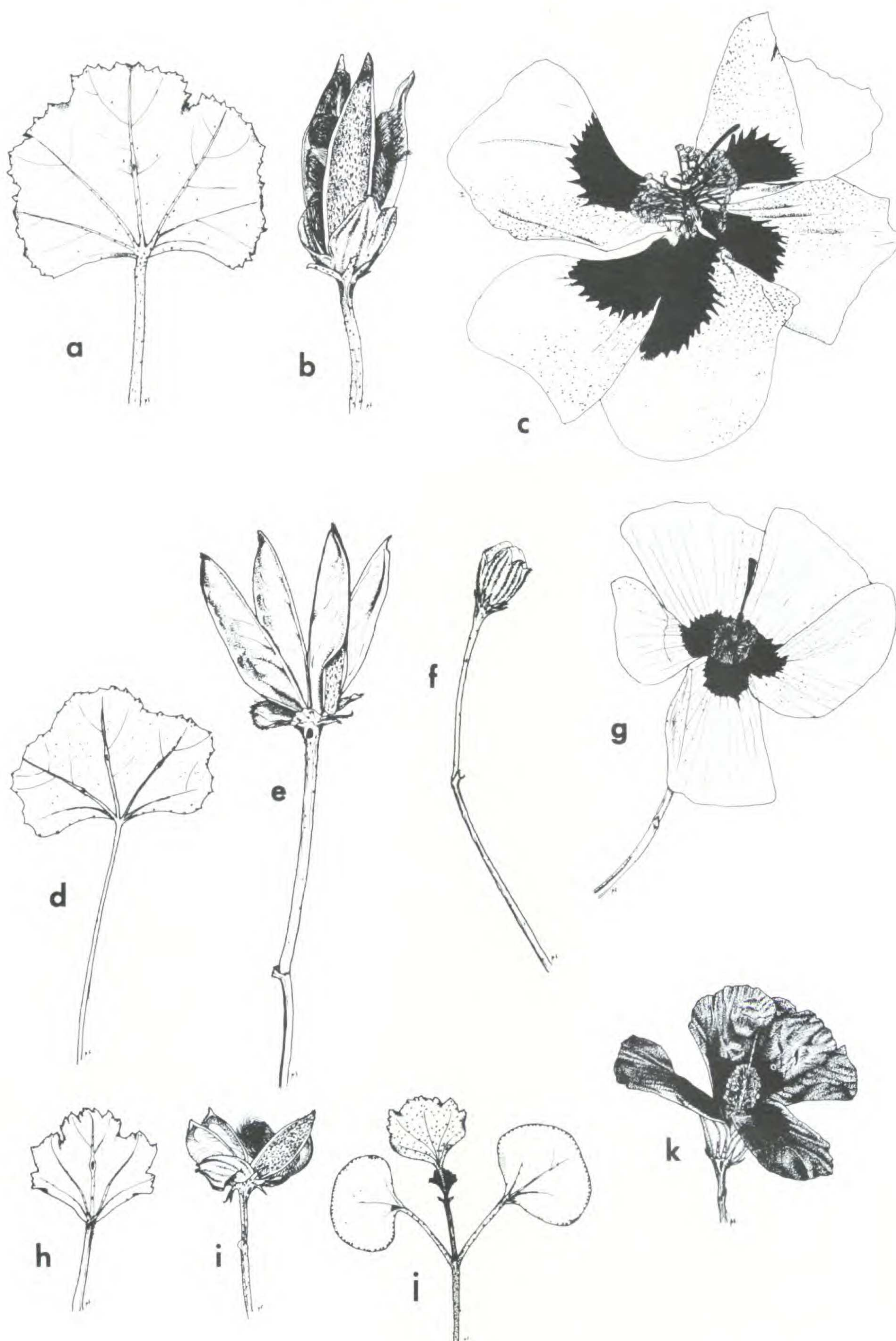


Fig. 18. A-C, *Cienfuegosia somaliana* Fryx. [Fryxell s.n. (TAES)]: A, leaf; B, mature fruit; C, flower. D-G, *Cienfuegosia welshii* (Anders.) Garcke [Fryxell 14006 (TAES)]: D, leaf; E, mature fruit; F, bud; G, flower. H-K, *Cienfuegosia hearnii* Fryx. [Fryxell 14005 (TAES)]: H, leaf; I, mature fruit; J, seedling with cotyledons shown; K, flower. All $\times 1$.

Escalante 417, LP -n.v.) from Corrientes. The type is from a saline environment.

ARGENTINA: SALTA: Antillas, Cerro Negro 700 m, orilla de un salitral, *Venturi* 10311 (GH, MO, NY, S, US). TUCUMAN: Dpto. Leales, La Florida, hab. bosque, 300 m, *Monetti* 14711 (G, LIL). SANTIAGO DEL ESTERO: Dpto. Leales, Los Puestos, *Meyer* 12798 (LIL).

23. *Cienfuegosia ulmifolia* Fryx., Britt. **19**: 35, 1967 [Type: Argentina: Chaco: Colonia Benitez, Dec. 1928, *Schulz* 170 (Holotype: BAB)]

Illustrations: Fig. 23, i-k; also Rodrigo (1941) Fig. 1, Fig. 3A (both labelled *C. argentina*); Fryxell (1967a) Fig. 1, a-d.

Stems weakly ridged, obscurely and minutely punctate (sometimes apparently epunctate), sparingly pubescent to glabrate, reddish-brown. Leaves simple, ovate to elliptic, serrate, truncate, acute, glabrate (or sparingly hirsute below), sometimes sparingly ciliate, 5-veined; veins reddish-brown below. Petioles $\frac{1}{4}$ - $\frac{1}{2}$ length of lamina, obscurely punctate, glabrate or sparingly puberulent near juncture with lamina, canaliculate, reddish-brown. Stipules sessile, auriculate (rarely falcate), acuminate (rarely toothed), glabrate or weakly ciliate, persistent, 3-11 mm long, 2-6 mm broad, 1-nerved, sometimes exceeding petioles. Peduncles 1-6 cm, weakly ridged, sparsely pubescent to glabrate, obscurely punctate. Involucel lacking. Calyx 15-ribbed, 10-20 mm (exceeding fruit), obscurely punctate, glabrous (or sometimes with a few scabrous hairs toward base of calyx tube, but none on apices of calyx lobes); calyx lobes 3-ribbed, lanceolate, acuminate to acute, glabrous. Petals 2-4 cm, yellow with large maroon spot on claw having yellow radii. Androecium maroon throughout; anther mass obovoid. Style sparsely punctate, exceeding androecium, undivided (or sometimes divided apically in sicco); stigma dark-red, pubescent, 3-lobed. Fruit 3-loculed, epunctate, 8-10 mm, globose to ovoid. Seeds 4-5 mm long, hairy; hairs appressed, tan. Embryo epunctate. Chromosome number: $n = 10$.

Distribution (Fig. 15): Paraguay: in the valley of the Río Paraguay from its confluence with the Río Apa south to the confluence with the Río Paraná; Argentina: Chaco, Corrientes, and Santa Fé in the valley of the Río Paraná. A single specimen from Tucumán extends this distribution to the west. This species occurs on sandy soils, on heavy clay, and frequently in saline situations.

PARAGUAY: BOQUERON: Puerto Casado, Estancia "Maria Casilda," *Pedersen* 4099 (BR, C, G, GH, US), *Gregory et al.* 10604 (LIL); Chaco Paraguayo, Orihuea, campo palmas, *Rojas* 5208 (G); Isla Poi-Orihuea, campo tierra arenosa, *Rojas* 7019 (G); San Salvador, dans les argiles impermeables, *Balansa* 1875a (P-p.p.); Itapucumí, *Rojas* 2599 (G, M).

ARGENTINA: CHACO: Dpto. Resistencia, Colonia Benitez, *Schulz* 170 (BAB), 622 (S), 10998 (LIL); Fontana, *Meyer* 2075 (GH, LIL). CORRIENTES: Dpto. Mburucuyá: Estancia Santa Teresa, *Pedersen* 477 (BR, C, P, S, US), *Schwarz* 8700 (LIL); Empedrado, *Schwarz* 9949 (LIL-p.p.). Dpto. San Luis del Palmar: 25 km E de S. Luis del Palmar, *Krapovickas & Cristóbal* 11805 (TAES). SANTA FE: Mocoví, Ocampo, *Venturi* 190 (BA, BAB, LIL, TAES), *Venturi* 190 bis (SI); Videla, *Ragonese* (BA-p.p.); Malabrigo, *Castellanos* 19563 (BA). TUCUMAN: *Diaz* 56 (BAB).

24. *Cienfuegosia hasslerana* Hochr. ex Chod. & Hassl., Bull. Herb. Boiss., ser. 2, **5**: 302, 1905 [Type: Paraguay: in arenosis salsis in regione cursus superioris fluminis Apa, Oct 1901, *Hassler* 7686 (Lectotype: G, isotypes: B (as photo MO), BM, GH, MICH, NY, P, S, UC)].

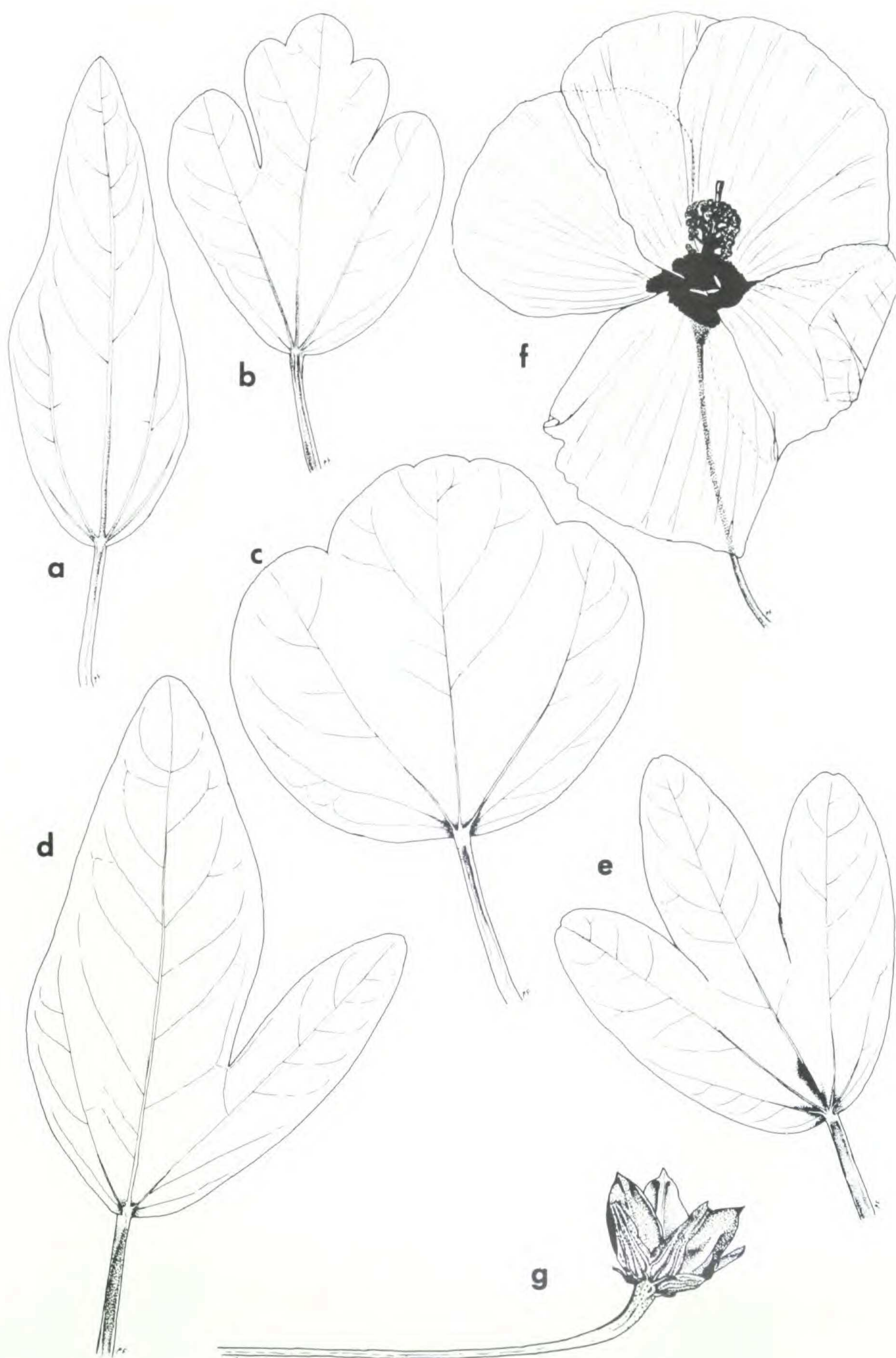
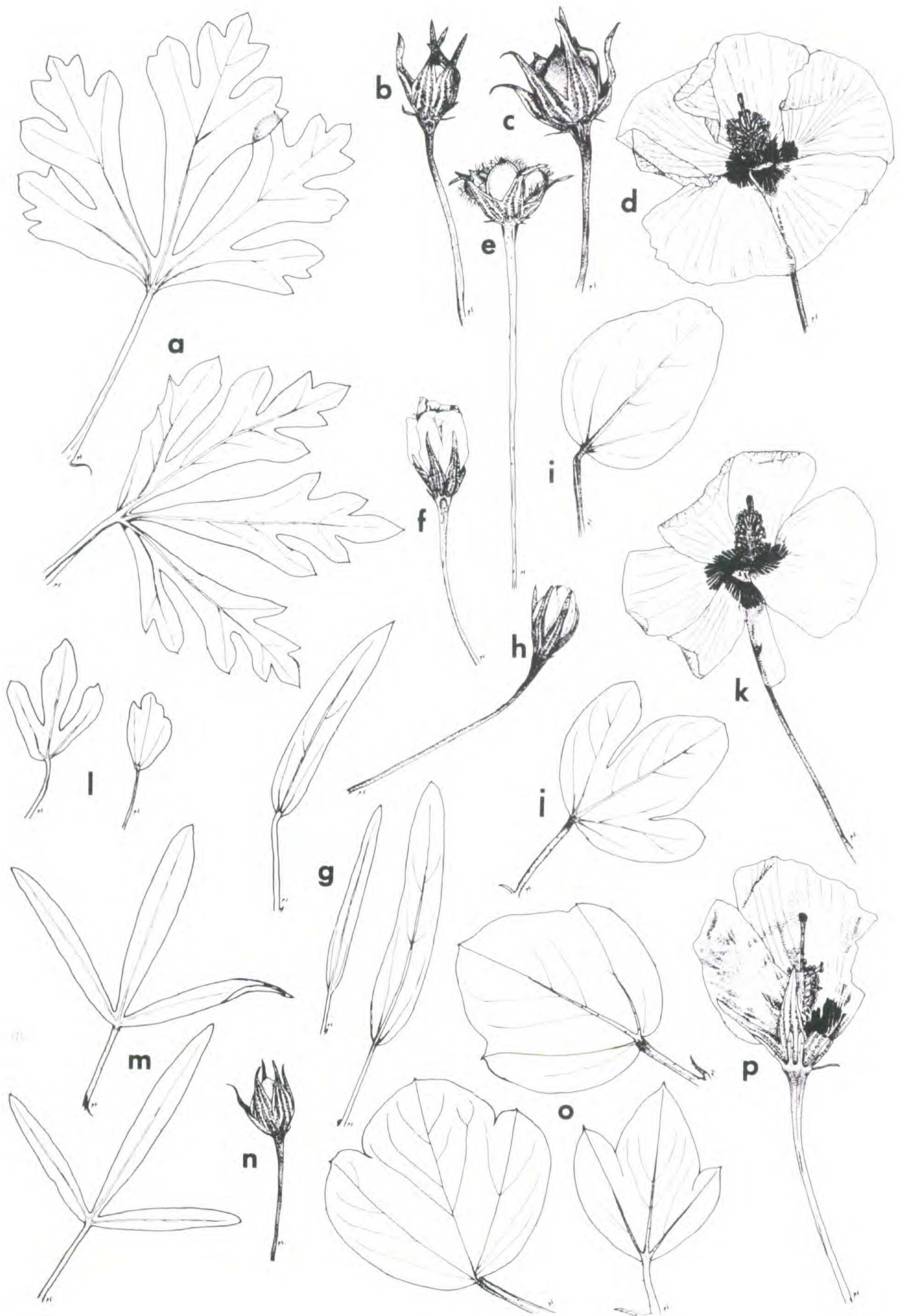


Fig. 19. *Cienfuegosia tripartita* (H.B.K.) Gürke [Fryxell s.n. (TAES)]: A-E, leaves, showing some of the variability encountered; F, flower; G, mature fruit. All $\times 1$.



C. argentina var. *hasslerana* Hassl., Repert. Spec. Nov. 7: 381, 1909.

C. escholtzioides Hochr. ex Chod. & Hassl., Bull. Herb. Boiss., ser. 2, 5: 302, 1905 [Type: Paraguay: in arenosis salsis in regione cursus superioris fluminis Apa, Nov 1901, Hassler 7686a (Lectotype: G, isotypes: BM, NY, S, UC)].

C. argentina var. *hasslerana* f. *escholtzioides* Hassl., Repert. Spec. Nov. 7: 381, 1909.

None of the duplicates of Hassler 7686 can be definitely identified as the holotype of *C. hasslerana*. Only the Geneva and British Museum specimens bear the name *C. hasslerana* Hochr., and in both cases the handwriting is Hassler's rather than Hochreutiner's. Unless the holotype is subsequently discovered, the specimen kept at Geneva is here designated as lectotype. The problem of identifying the holotype of *C. escholtzioides* is similar, and the Geneva specimen of Hassler 7686a is also designated as lectotype:

Illustrations: Fig. 23, l-o.

Stems slender, weakly ridged, obscurely punctate, glabrate. Leaves glabrate, pinnatisect to moderately parted (or sometimes simple, cuneiform, and apically dentate on reduced lower leaves). Petiole canaliculate, glabrous or slightly hirsute near juncture with lamina, $\frac{2}{3}$ length of to equaling lamina, obscurely punctate. Stipules auriculate (sometimes subulate), sessile, glabrous to ciliate, 1-nerved, minutely punctate, 2-7 mm long, 1-3 mm broad. Peduncles glabrate (or with a few bristles at summit), obscurely punctate, 2-4½ cm, ridged. Involucel lacking (vestigial bractlets discernible on *Balansa 1875a* and *Krapovickas et al. 14249*). Calyx 10-18 mm, 15-ribbed, glabrate or somewhat bristly basally but glabrous apically, scarious intercostally, obscurely punctate (sometimes appearing epunctate); lobes 3-ribbed, glabrous, narrowly lanceolate, acuminate, sometimes acute). Petals 2-3½ cm, yellow with large maroon spot having poorly developed yellow radii on claw. Androecium maroon throughout; anther mass obovoid. Style greatly exceeding androecium (nearly equaling petals), punctate, pallid, undivided (or sometimes slightly divided); stigma pubescent, pink to red, 3-lobed. Fruit epunctate, elliptic, 8-10 mm, 3-loculed. Seeds 3-4 mm, comose; seed hairs appressed, tan.

The leaf of *C. hasslerana* is characteristically deeply dissected, but plants produce occasional reduced, undissected leaves. This variability reaches its extreme expression in an isotype of *C. hasslerana* (Hassler 7686, UC). Other sheets of this same plant, notably the lectotype (G), show the deeply dissected leaf typical of the species. Both types of leaves are found on the same branch in many specimens, such as another isotype (S).

Distribution (Fig. 16): Paraguay and southward into the Argentine province of Corrientes.



Fig. 20. A-D, *Cienfuegosia digitata* Cav. [Fryxell 14008 (TAES)]: A, two leaves; B, bud; C, mature fruit; D, flower. E-G, *Cienfuegosia yucatanensis* Millsp.: E, mature fruit [Fryxell s.n. (TAES)]; F, day-old flower [Dunbar 146 (GH)]; G, three leaves [Dunbar 146 (GH)]. H-K, *Cienfuegosia heterophylla* (Vent.) Garcke [Miller & Johnston 66 (GH)]: H, bud; I-J, leaves; K, flower. L-N, *Cienfuegosia subternata* (Hassl.) Fryx. [Fiebrig 4022 (GH)]: L, two reduced lower leaves; M, two climax leaves; N, bud. O-P, *Cienfuegosia rosei* Fryx. [Nelson 2779 (GH)]: O, three leaves; P, flower. All $\times 1$.

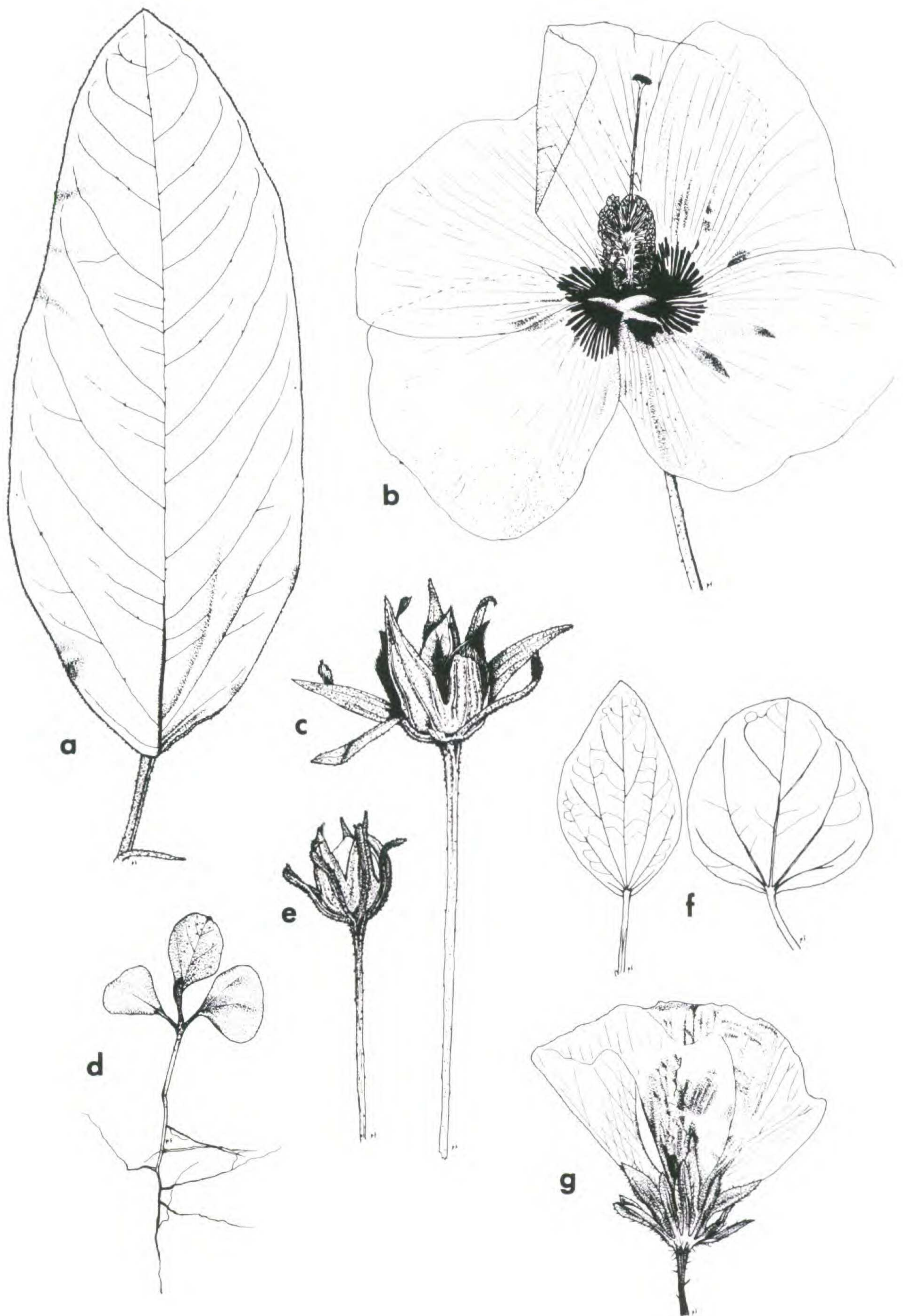


Fig. 21. A-E, *Cienfuegosia affinis* (H.B.K.) Hochr. [Fryxell 15011 (TAES)]: A, leaf; B, flower; C, mature fruit; D, seedling with cotyledons shown; E, bud. F-G, *Cienfuegosia subprostrata* Hochr. [Hassler 6011 (GH)]: F, two leaves; G, flower. All $\times 1$.

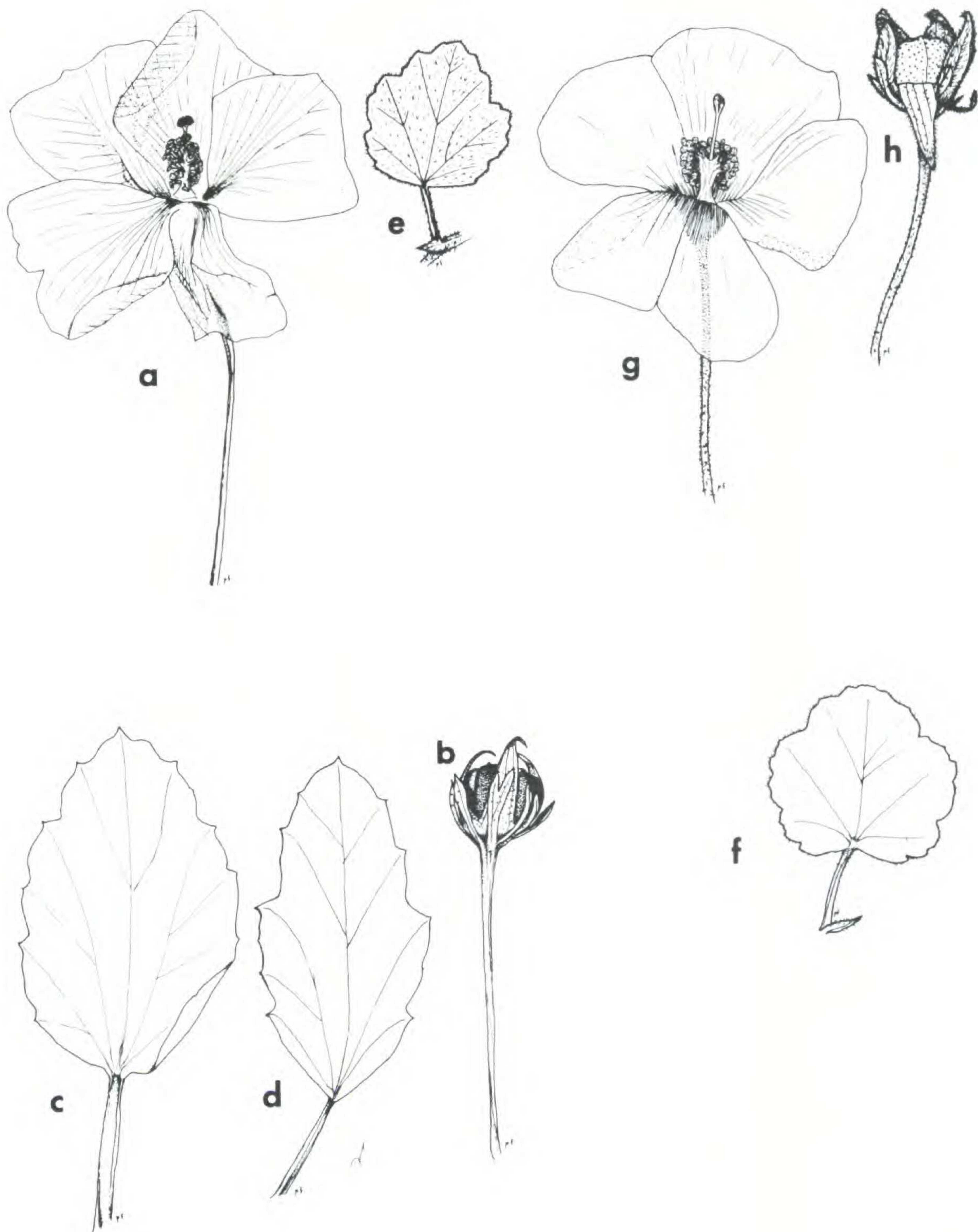
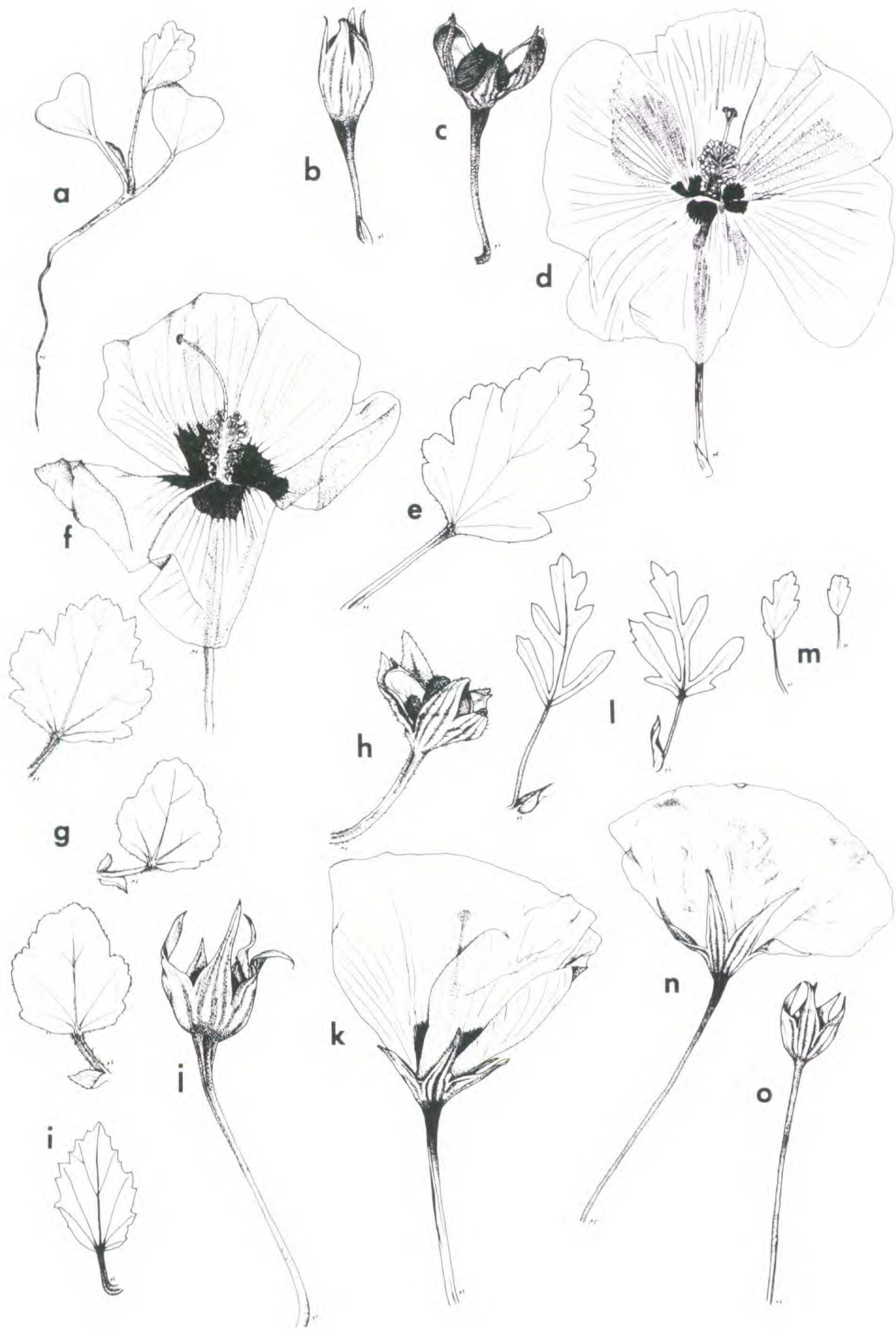


Fig. 22. A-D, *Cienfuegosia drummondii* (A. Gray) Lewt.: A, flower [Fryxell 15005 (TAES)]; B, mature fruit [Fryxell 436 (TAES)]; C-D, leaves [Fryxell 15005 (TAES)]. E-H, *Cienfuegosia sulfurea* (St.-Hil.) Garcke [Fryxell 15007 (TAES), except F, Müsch 995 (GH)]: E-F, leaves; G, flower; H, immature fruit. All $\times 1$.

The ecological adaptation of this species is apparently similar to that of the other species of this section. A notation on the type, "in arenosis salsis," indicates an affinity for sandy soils and a saline environment.

PARAGUAY: In arenosis salsis in regione cursus superioris fluminis Apa, Hassler 7686 (B, BM, G, GH, MICH, MO, NY, P, S, UC), 7686a (BM, G, NY, S, UC); zwischen Río Apa und Río Aquidabán, Fiebrig 5000 (G, K, L); alto Paraguay, San Salvador, Rojas 2587



(G, M), *Balansa 1875a* (P-p.p.); Belén (20 km SE de Concepción) en campo, *Krapovickas et al. 14249* (CTES, TAES).

ARGENTINA: CORRIENTES: Arroyo Mocoretá, *Castellanos 34435* (BA, M); Dpto. Mburucuyá, Santa María, *Pedersen 5042* (C, P, S); Paso de los Libres, 10 km al NW, *Cristóbal et al. 86* (LIL).

REJECTED NAMES AND EXCLUDED SPECIES

Rejected names:

- Cienfuegosia affinis* var. *humilis* (Gürke) Hochr. — illegitimate, Article 63.
C. Bentharii Hochr. — illegitimate, Article 67.
C. Drummondii var. *genuina* Hassl. — illegitimate, Article 26.
C. phlomidifolia var. *humilis* Gürke — illegitimate, Article 63.
C. punctata (Cunn. ex Benth.) Domin — illegitimate Articles 64 and 67.
C. subprostrata var. *vera* Hassl. — illegitimate, Article 63.
C. sulphurea (H.B.K.) Hassl. — illegitimate, Article 64.
All combinations with *Fugosia* Juss. must also be rejected, as discussed on p. 180, because of the priority of *Cienfuegosia* Cav.

Excluded species (including combinations both in *Cienfuegosia* and in *Fugosia*):

- | | |
|--|--|
| <i>C. althaeoides</i> Chiov. | (= <i>Hibiscus ludwigii</i> Eckl. & Zeyh.) |
| <i>C. anomalum</i> (Wawr.) Gürke | (= <i>Gossypium anomalum</i> Wawr. ex Wawr. & Peyr.) |
| <i>C. australis</i> (F. Muell.) K. Schum. | |
| = <i>F. australis</i> (F. Muell.) Benth. | (= <i>Gossypium australe</i> F. Muell.) |
| <i>C. australis</i> var. <i>microcarpa</i> Domin. | (= <i>Gossypium australe</i> F. Muell.?) |
| <i>C. Bentharii</i> Hochr. [basionym:
<i>F. punctata</i> Cunn. ex Benth.] | (= <i>Gossypium cunninghamii</i> Tod.) |
| <i>C. Bricchetti</i> Ulbr. | (= <i>Gossypium somalense</i> (Gürke) Hutch.) |
| <i>C. cuneiformis</i> (DC.) Hochr. | |
| = <i>F. cuneiformis</i> (DC.) Benth. | (= <i>Alyogyne cuneiformis</i> (DC.) Alef.) |
| <i>C. Ellenbeckii</i> Gürke | (= <i>Gossypium somalense</i> (Gürke) Hutch.) |
| <i>C. flaviflora</i> (F. Muell.) Hochr. | |
| = <i>F. flaviflora</i> F. Muell. | (= <i>Thespesia lampas</i> (Cav.) Dalz. ex Dalz. & Gibs. var. <i>thespesioides</i> (R. Br. ex Benth.) Fryx.) |
| <i>C. gossypioides</i> (R. Br.) Hochr. | (= <i>Gossypium sturtianum</i> J. H. Willis) |
| <i>C. hakeaefolia</i> (Giord.) Hochr. | |
| = <i>F. hakeaefolia</i> (Giord.) Hook. | (= <i>Alyogyne hakeaefolia</i> (Giord.) Alef.) |
| <i>C. hakeaefolia</i> var. <i>lilacina</i> (Lindl.) Hochr. | |
| = <i>F. lilacinus</i> (Lindl.) G. Don ex Loud. | (= <i>Alyogyne hakeaefolia</i> (Giord.) Alef.) |
| <i>C. incana</i> Schwartz | (= <i>Gossypium incanum</i> (Schwartz) Hillc.) |
| <i>C. latifolia</i> (Benth.) Hochr. | |
| = <i>F. latifolia</i> Benth. | (= <i>Gossypium costulatum</i> Tod.) |
| <i>C. Palmeri</i> Rose | (= <i>Gossypium aridum</i> (Rose & Standl.) Skov.) |
| <i>C. pedata</i> (Bail.) Domin. | |
| = <i>F. pedata</i> Bail. | (= <i>Gossypium bickii</i> Prokh.) |
| <i>C. pentaphylla</i> K. Schum. | (= <i>Gossypium anomalum</i> Wawr. ex Wawr. & Peyr.) |



Fig. 23. A-E, *Cienfuegosia argentina* Gürke [Fryxell 15003 (TAES)]: A, seedling with cotyledons shown; B, immature fruit; C, mature fruit; D, flower; E, leaf. F-H, *Cienfuegosia hispida* R. E. Fries [Venturi 10311 (GH)]: F, flower; G, three leaves; H, mature fruit. I-K, *Cienfuegosia ulmifolia* Fryx.: I, leaf [Krapovickas & Cristóbal 11805 (TAES)]; J, immature fruit [Pedersen 4099 (GH)]; K, flower [Krapovickas & Cristóbal 11805 (TAES)]. L-O, *Cienfuegosia hasslerana* Hochr. ex Chod. & Hassl. [Hassler 7686 (GH)]: L, two climax leaves; M, two reduced, lower leaves; N, flower; O, immature fruit. All $\times 1$.

- C. populifolia* (Benth.) Hochr.
= *F. populifolia* Benth. (= *Gossypium populifolium* (Benth.)
F. Muell. ex Tod.)
- C. pulchella* C. A. Gardn.
= *F. pulchella* C. A. Gardn. (= *Gossypium pulchellum* (C. A. Gardn.)
Fryx.)
- C. punctata* (Cunn. ex Benth.) Domin.
= *F. punctata* Cunn. ex Benth. (= *Gossypium cunninghamii* Tod.)
- C. robinsonii* (F. Muell.) Hochr.
= *F. robinsonii* F. Muell. (= *Gossypium robinsonii* F. Muell.)
- C. somalensis* Gürke (= *Gossypium somalense* (Gürke) Hutch.)
- C. thespesioides* (R. Br. ex Benth.) Hochr.
= *F. thespesioides* R. Br. ex Benth. (= *Thespesia lampas* (Cav.) Dalz. ex Calz
& Gibs. var. *thespesioides* (R. Br. ex
Benth.) Fryx.)
- C. triphylla* (Harv. ex Harv. & Sond.)
K. Schum.
= *F. triphylla* Harv. ex Harv. & Sond. (= *Gossypium triphyllum* (Harv. ex Harv.
& Sond.) Hochr.)
- F. areysiana* Defflers (= *Gossypium areysianum* Defflers)
- F. Grantii* (Mast. ex Oliv.) Hochr. (= *Kosteletzkya Grantii* (Mast. ex Oliv.)
Garcke)
- F. hakeaefolia* var. *coronopifolia* (Miq.)
Benth. (= *Alyogyne hakeaefolia* (Giord.) Alef.)

In addition to the preceding rejections and exclusions, a few additional names have appeared in the literature that have apparently never been validly published. These names have no standing under the Rules and must be regarded as *nomina nuda*. They are:

- C. Dinteri* Ulbr. ex Skov nom. nud. (= *Gossypium herbaceum* var. *dinteri* Ulbr.?)
- F. hildebrandti* ex Youngman
- C. cuneata* (Benth.) Hutch. nom. nud.
- F. sulphurea* var. *trifida* Griseb. ex Rodrigo nom. nud.

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INDEX OF COLLECTORS

(Type specimens in boldface)

Adams 4013	<i>C. heteroclada</i>	Cabrera 10572	<i>C. sulfurea</i>
——— & Akpabla 4364	<i>C. heteroclada</i>	Carenzo 322	<i>C. argentina</i>
Adanson 145A	<i>C. digitata</i>	Castellanos 34435	<i>C. hasslerana</i>
Aguilar 269	<i>C. argentina</i>	——— s.n., 1168, 34437	<i>C. sulfurea</i>
——— 640, 1037	<i>C. sulfurea</i>	——— 19563	<i>C. ulmifolia</i>
——— 63, 1263	<i>C. drummondii</i>	——— 1170, 19560	<i>C. drummondii</i>
——— 1171	<i>C. sulfurea</i> & <i>C. drummondii</i> (mixed)	Chapman s.n.	<i>C. yucatanensis</i>
Ahiokpor s.n.	<i>C. heteroclada</i>	——— 3041	<i>C. drummondii</i>
Andersson 135	<i>C. tripartita</i>	Chevalier s.n., 24535	<i>C. digitata</i>
Ansits 2163	<i>C. drummondii</i>	Claussen 374, 549, 590	<i>C. affinis</i>
Arechavaleta 1524	<i>C. sulfurea</i>	Clover 1259	<i>C. drummondii</i>
Argañarás 144	<i>C. argentina</i>	Codd 5229	<i>C. hildebrandtii</i>
Asp 89	<i>C. drummondii</i>	——— 8873	<i>C. digitata</i>
Asplund 5661	<i>C. tripartita</i>	Comezaria 2727	<i>C. drummondii</i>
Baez 12	<i>C. drummondii</i>	Correa 29	<i>C. drummondii</i>
——— 75	<i>C. sulfurea</i>	Cristóbal, Ahumada & de la Sota 86	<i>C. hasslerana</i>
Balansa 1875	<i>C. drummondii</i>	Crovetto & Cherini 6109	<i>C. drummondii</i>
——— 1875a	<i>C. ulmifolia</i> & <i>C. hasslerana</i> (mixed)	——— & Leguizamon 4913	<i>C. sulfurea</i>
Balegno 612	<i>C. sulfurea</i>	——— & Piccinini 4701	<i>C. sulfurea</i>
——— 729, 1097	<i>C. drummondii</i>	Curran & Haman 1072	<i>C. affinis</i>
Bally 9674, 11910	<i>C. somaliana</i>	Curtiss 398	<i>C. yucatanensis</i>
Basaldua s.n.	<i>C. drummondii</i>	DaCosta 27A	<i>C. affinis</i>
Bebbington 1693	<i>C. digitata</i>	Daguery 967	<i>C. drummondii</i>
Beccari s.n.	<i>C. welshii</i>	Dalziel 122	<i>C. heteroclada</i>
Berhaut 1344	<i>C. digitata</i>	Davey 224, 233	<i>C. digitata</i>
Berro 1466	<i>C. sulfurea</i>	DeCarvalho 219	<i>C. hildebrandtii</i>
Berti & Escalante 417	<i>C. hispida</i>	Deflers s.n., 60	<i>C. welshii</i>
Blanchet 2702	<i>C. heterophylla</i>	Dennis 2278	<i>C. affinis</i>
Blaumer 9	<i>C. heterophylla</i>	DeWinter & Leistner 5110	<i>C. digitata</i>
Blodgett s.n.	<i>C. yucatanensis</i>	Diaz 3	<i>C. argentina</i>
Boelcke 1519	<i>C. drummondii</i>	——— 56	<i>C. ulmifolia</i>
Boldingh 6383	<i>C. heterophylla</i>	——— 63	<i>C. drummondii</i>
Borle 257, 551	<i>C. hildebrandtii</i>	Dinter 669 , 7215, 7459	<i>C. digitata</i>
Borsini 1254	<i>C. drummondii</i>	Drummond, T. 42	<i>C. drummondii</i>
Brade 13440	<i>C. affinis</i>	Drummond, R. B. & Hemsley 2285	<i>C. hildebrandtii</i>
Braga 82	<i>C. hildebrandtii</i>	——— & Seagrief 5215	<i>C. digitata</i>
Breyer 20592	<i>C. digitata</i>	Drushell 114, 176	<i>C. drummondii</i>
Britton 521	<i>C. heterophylla</i>	Ducke 2068	<i>C. affinis</i>
——— & Britton 211	<i>C. heterophylla</i>	Dunbar 146	<i>C. yucatanensis</i>
Buckley s.n.	<i>C. drummondii</i>	Dupré s.n.	<i>C. sulfurea</i>
Buratovich 284, 338	<i>C. drummondii</i>	Edwards 3298	<i>C. hildebrandtii</i>
Burchell 5620	<i>C. affinis</i>	Eggers 350	<i>C. heterophylla</i>
Burtt-Davy 10572	<i>C. hildebrandtii</i>	——— 13560	<i>C. affinis</i>
Buswell 1387	<i>C. yucatanensis</i>	——— 14767	<i>C. tripartita</i>
		Eifrig 21	<i>C. drummondii</i>

Ekman 15487	<i>C. yucatanensis</i>	———— 5444, 9376,	
Elias 183, 223, 398	<i>C. affinis</i>	10221	<i>C. integrifolia</i>
Enti & Agyakwa s.n.	<i>C. heteroclada</i>	———— 6011	<i>C. subprostrata</i>
Escobar 13	<i>C. drummondii</i>	———— 7686, 7686a	<i>C. hasslerana</i>
Exell & Mendonça 2694,		Haught 4352, 4473	<i>C. heterophylla</i>
2789, 2872	<i>C. digitata</i>	———— s.n., 40, 191	<i>C. tripartita</i>
Fendler 105, 106	<i>C. affinis</i>	Haygarth s.n.	<i>C. gerrardii</i>
Ferreyra 5962	<i>C. tripartita</i>	Hayward 01464, 01465	<i>C. drummondii</i>
Fiebrig 1233	<i>C. drummondii</i>	Hearn 4	<i>C. hearnii</i>
———— 4022, 5230	<i>C. subternata</i>	Heller 1808	<i>C. drummondii</i>
———— 5000	<i>C. hasslerana</i>	Hemming 2187	<i>C. welshii</i>
Flossdorf s.n.	<i>C. drummondii</i>	Heudelot s.n.	<i>C. digitata</i>
Fries 1446	<i>C. argentina</i>	Hicken s.n.	<i>C. sulfurea</i>
Fruchard s.n.	<i>C. sulfurea</i>	Hildebrandt 780a	<i>C. welshii</i>
Fryxell s.n.	<i>C. somaliana</i>	———— 2325	<i>C. hildebrandtii</i>
———— s.n.	<i>C. tripartita</i>	Hjalmarson s.n.	<i>C. heterophylla</i>
———— 436, 701, 15006,		Hoehne 171, 198, 4615	<i>C. affinis</i>
15012	<i>C. drummondii</i>	Holmberg s.n.	<i>C. argentina</i>
———— 749	<i>C. rosei</i>	Honold 20	<i>C. digitata</i>
———— 14001, 14007	<i>C. hildebrandtii</i>	Hooker & T. s.n.	<i>C. welshii</i>
———— 14005	<i>C. hearnii</i>	Humboldt & Bonpland s.n.	<i>C. heterophylla</i>
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